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MUSEUM

OF THE

Geological Survey of Alabama

EUGENE A. SMITH, Ph. D., Director

The Museum as an Educator

...BY...

HERBERT H. SMITH, Curator

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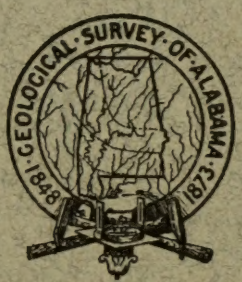

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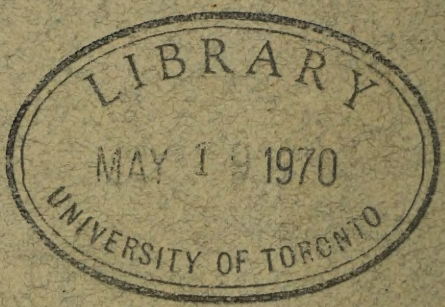


Museum of the Geological Survey of Alabama—Main Exhibition Room

EDUCATIONAL PAPERS. I.

THE MUSEUM AS AN EDUCATOR

THE MUSEUM DEFINED.

Presumably, when Mr. P. T. Barnum opened a stationary show in New York and called it "Barnum's Museum," he was not aiming a blow at science; but science felt it, and, in a measure, is feeling it yet. At that time real public museums were hardly known in this country; so Americans, very naturally, thought only of the bogus one. Barnum was not the first to misuse our time-honored name, but he was successful and was followed by cheap imitators who made matters worse. To this day, many persons suppose that a museum is "a place where they show curiosities"—specifically, dwarfs, bearded ladies and two-headed calves. With such an idea, is it any wonder that they are indifferent?

Fortunately for us, this absurdity is dying out, and every well informed person knows that the museum is not a catch-penny show. In point of fact, the old Greek word which has come down to us through the Latin has not changed greatly in meaning. The museum was, and is, a temple of the Muses, the home of learning and art. Painting, sculpture and music, history and science gathered in the old Greek temples—all that was noblest and best in a glorious civilization; there the great philosophers taught and authors read their scrolls and Homer was recited. A few centuries later the Museum at Alexandria was a library and university, the most renowned of its time.

It has been said, and truly, that museums cannot exist until the community has reached a high state of civilization; while men are occupied in the mere struggle for existence they have small leisure and less inclination to cultivate their minds. There were no museums during the centuries of turmoil that followed the destruction of the Roman Empire; there was none in England until after the civil wars, until the English were no longer satisfied with squalid country-houses and gross feeding and the bare rudiments of knowledge, but were reaching after

beauty and culture; there was none in America until the pioneer settlements had grown into rich cities and ordered communities. The Renaissance was first felt in Italy, and for two or three centuries that was the most enlightened part of the world; it is significant that museums were formed in several Italian cities, and they are the oldest in Europe.

Museums, then, mark a stage in civilization, and a very advanced stage; they do not come because a few enthusiasts want them, but because the community is ready. Of course there are plenty of men who can see no use in them; men who are not broad enough to comprehend that the world is advancing and needs such things now, though it did without them before. They use the old argument, "what was good enough for my grandfather is good enough for me." Nonsense! Your grandfather could jog on horseback, but your automobile is better and will do the journey in half the time. Your grandfather was satisfied with Yankee Doodle; your musical taste has been cultivatsd and you demand Wagner. Your grandfather was interested in potato bugs, and you want an entomological collection—or will want it as soon as you appreciate its charm.

We have come to use the name museum in a special way, for an institution devoted to natural science—geology, biology and their kindred branches; for convenience I shall keep to the restricted sense in this paper. But I should explain that the word has been, and is, used for many cults. The British Museum, at first, was a library and cabinet of antiquities, to which other things have been added. The Metropolitan Museum is an art gallery; the Confederate Museum at Richmond is historical; we have museums of textile arts, the Patent Office Museum and the Post Office Museum. All these have a perfect right to the name; they are not carried on for money-making and, assuredly, they are not vulgar.

Broadly speaking, a museum of natural history has three spheres of work: 1st, scientific; 2nd, economic; 3rd, educational. I shall only mention the first two incidentally; sometimes, indeed, the economic branch is largely relegated to other institutions. But I am bound to call your attention to one fact, and it cannot be impressed too strongly. The economic and educa-

tional branches spring from the scientific one and are nourished by it. We cannot teach or use science unless we have it ourselves, and we cannot have it without patient study. Well-arranged exhibition rooms are not mere matters of individual taste; they depend on well-arranged collections, the result of years of labor by specialists. The scientific work is out of sight, and a chance visitor may imagine that it is neglected or unimportant; in simple truth, the museum could not exist without it. The demagogue who urges that we should have *nothing but* exhibition rooms or public lectures or economic work is preaching an absurdity; he might as well say that a compass and drawing table are all that is necessary for an engineer and that he has no use for mathematics; he might as well expect a carpenter to work without tools or a farmer to plant without seed.

THE EDUCATIONAL MUSEUM.

Like everything else, the museum is an evolution. In its infancy it was little more than a collection, open to a few specialists but barred against the general public. The first exhibition marked an era in education. Of course, its promotors had no idea of this; they enjoyed looking at the specimens, they were good-natured and wanted to share their pleasure with other people; that was all. The means at their disposal were inadequate; some dark iittle rooms, shelves and cases which, fortunately, concealed more than they revealed. Compare this, for instance, with the American Museum of Natural History at New York. It is planned to cover four city blocks and already occupies a great part of two. Four stories are devoted to magnificent exhibition halls, nearly two miles of them, where every case is as nearly perfect as science and art can make it. In truth, the very richness of the place is bewildering; wiser persons go only to one hall, or two. Everywhere you see groups of visitors, quiet people, some fashionably dressed, but there is a good sprinkling of workmen with now and then a bare-footed boy; teachers lead their classes from one object to another; students work with note-book and pencil; here a school boy hangs over some case and perhaps you may see him comparing specimens which he has brought. In these halls the museum

has gathered the work of hundreds of skilled men, it has expended years of anxious thought and study and millions of dollars. They are strictly and solely educative. The rooms are *not* a gift to science; they are a gift *from* science to education and the world, and for this science has enlisted art, ingenuity, money, anything and everything that makes to her end—teaching. Any one who imagines that the naturalist needs these cases for his work has simply no conception of scientific methods. The study collections are out of sight, in laboratories and store-rooms on the top floor; plain cabinets and drawers contain far more specimens than the public cases, but but they are arranged compactly, for reference. There is no attempt to make things attractive; the naturalist wants well-preserved specimens, but an unmounted skin is better for his purpose than a mounted one and a tightly-closing insect-box than a glass-covered one. The American Museum is doing splendid scientific work, but *not* because it has exhibition rooms. It is significant, however, that this and other large institutions give more money to the educational branch than they do to the scientific one.

THE MUSEUM AN OBJECT LESSON.

Every experienced teacher knows the value of object-lessons. If you tell a kindergarten child that a plane triangle has three sides meeting in three angles he will have no conception of your meaning; show him a cardboard triangle and he will comprehend at once. The pupil in geography may read that polar bears and musk-oxen live within the arctic circle, but the words have only a hazy meaning; his real impression comes from a picture at the top of the page. Show him a bear-skin and he is interested; show him one of the splendid group cases in a museum, with savage white bears in their icy home, and the interest rises to enthusiasm. No doubt a visit to the zoological garden would be still more effective and a hunting trip to Greenland best of all. But we cannot take our classes all over the world, and we cannot often see zoological or botanical gardens or aquaria. The museum is accessible, it is convenient for classes or pupils, and it is attractive; people learn unconsciously, whether they want to or not. In other

Group of Prong-horn Antelope. Field Museum of Natural History, Chicago
By courtesy of the Director

words, the museum system is object-teaching applied to natural science and carried to the highest degree of perfection.

GROWTH OF THE MUSEUM IDEA.

From the dark little rooms of bygone days to the National Museum, or the American, may seem a far call; but one has grown out of the other just as surely as the oak grows from an acorn. And the constant feature of this growth has been improvement on every line—buildings, rooms, cases, specimens, arrangement, labels and, above all, methods. In our day a mineral or fossil intended for exhibition is carefully selected from perhaps a thousand others; all extraneous matter is clipped off, and the object is as clean as soap and water will make it; it is mounted on a block or placed in a tray, neatly and legibly labeled, and protected from dust by a tight case of the best and cleanest glass. Some fossil species—skeletons of mammals or huge saurians—are known only by single specimens, or one specimen only may be perfect. Of course, such an object must be kept in one museum; formerly the world at large could know it only by pictures and descriptions. The use of plaster casts has made it possible to reproduce these treasures of science for other museums; a score or a hundred may be made from a single specimen, and for educational purposes they are just as good as the originals. An extinct species is often known from fragmentary specimens, but by studying a large number of these the naturalist can reconstruct the creature in his own mind. It remains only to reconstruct it in a drawing or a plaster cast; this has been done many times, and the resulting models are invaluable for our exhibition rooms. That useful substance, plaster, also gives us relief maps, models of volcanoes and glaciers, geological sections and so on.

TAXIDERMY AND GROUP-CASES.

The old-time naturalist was his own hunter, and often a very good one; but he was also his own preparator, and almost always a very bad one. With the demand for better mounted specimens came taxidermy—at first a trade, but now a fine art, almost worthy to stand with painting and sculpture. The ob-

ject of a modern group-case is to show birds or animals exactly as they would be in their native haunts; a forest home as the hunter sees it sometimes, but as you and I can *not* see it except by rare chance or infinite care. Portrait painters study faces at their leisure, in all lights and under all conditions; but to catch the finer characters they must have many sittings. Animals, too, have character and expression, and it is far more difficult to observe them. The naturalist cannot choose place and time; he must devote weeks or months or years to his task. With softest footsteps and every sense alert he steals to some point of vantage, for these are timid creatures; a waft of air may betray him, or a broken twig, and all his care is lost. If he does glimpse the scene it is through a tangle of foliage that he dares not brush aside; quick eye and quicker camera are busy for an instant and then—his models have disappeared; to all appearance there is not an animal within a thousand miles. If the man is a true artist he will return again and again, watching for chances, studying every detail, absorbing the picture until he has made it his own; then it may go down to the ages.

It speaks well for such enthusiasts that they rarely disturb the home they have studied; other individuals of the species will serve the purpose as well, and even these are only killed because they must be. Then the taxidermist—who may be the same man or another—takes up the task. No gentleman is more carefully measured for the coat which he will wear than the forest creature is for the coat that is to be taken off. Generally a single opening is made and the skin is taken off as a lady removes her glove, but more carefully, to prevent stretching. A plaster cast of the carcass is made, sometimes in sections if the animal is a large one. In a final visit to the home scene, samples of earth and plants are gathered; these are to be reproduced in papier maché. Sometimes, if the den or nest is not too large, it is taken away entire, or parts may be taken. Foot-prints are copied in plaster; if the animal is carnivorous, refuse bones and feathers are picked up after noting their exact positions; dead mussel-shells, fragments of nuts and gnawed twigs are preserved if they are part of the scene, or the root of a tree is dug up if there is a burrow beneath.

Most of the old-fashioned "stuffed" animals were caricatures; our modern taxidermists slip a skin over the plaster mold, a vast improvement. But the finer touches may go on for months, and the artist always has photographs before him; every bit of the skin is manipulated, every swell and fold and feature; moods are depicted in tense muscle or snarling lips; hardly a hair is left untouched. Meanwhile the accessories—plants, rocks, ground or water—are built in by trained modelers. A dust-proof case of suitable form and size is ordered; for a large group, this alone may cost several thousand dollars. At length the result is placed in the public rooms—an exact reproduction of animal home life.

It is folly to speak of such an exhibit as a "show." Attractive it is, but attractive because it combines scientific method with the highest art; and it teaches as nothing else can, because it appeals to eye and understanding alike.

A museum like that at Washington may keep a whole corps of taxidermists in its employ, reinforced by a corps of modelers. A very large case—say of musk-oxen or giraffes—may be the work of years, with several arduous expeditions; and thirty or forty thousand dollars will not cover the expense.

I have dwelt on these group-cases because they are, perhaps, nearer perfection than anything else in our exhibition rooms. Almost equally fine are some of the ethnological exhibits, figures of Indians modeled in clay. In other departments various devices are used. For example, preserved fish specimens soon lose their brilliant tints, though they serve perfectly well for study. Many museums now show casts of fishes and batrachians, taken from fresh specimens and colored to the life; these, of course, are useless for anatomy and they do not show microscopic surface characters, but for the ordinary observer they reproduce the living creature. A "biological case" of insects depicts the life history, eggs, larvæ in different stages, pupa, imago, food-plant, nest, burrow or coccoon, and destructive parasites; if the species is injurious to crops, such a case may have special value for the farmer. Enlarged models of insects are a recent and useful addition. Shells are attractive always, but we supplement the conchological collections by sections and papier-maché models. Large crustacea are mount-

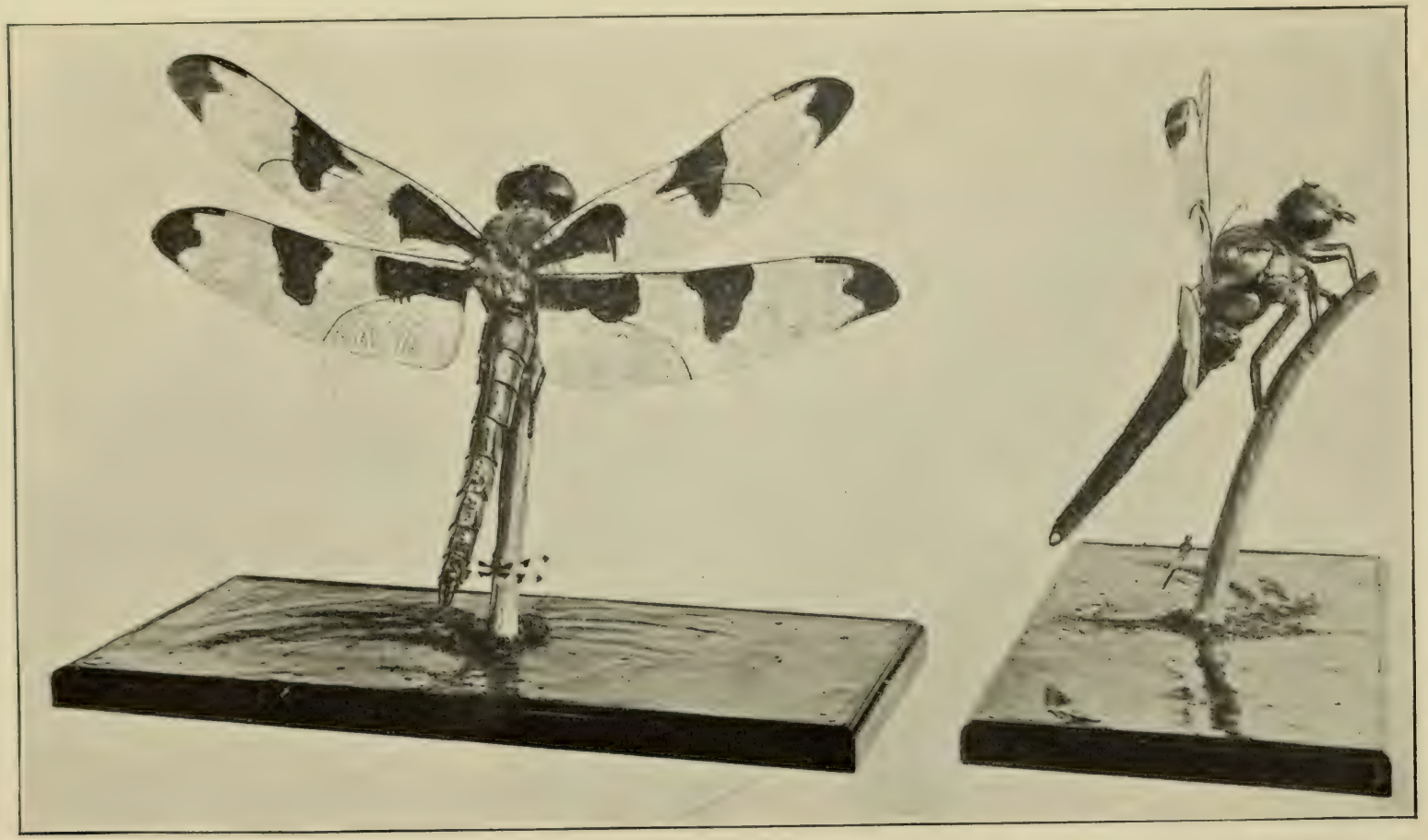
ed to show their structure, dried star-fishes and sea-urchins are placed beside drawings of the curiously dissimilar young. For years such objects as jelly-fishes and sponges could not be shown at all; now they are imitated, fairly well, in glass; and we have enlarged glass models of microscopic creatures. Attempts have even been made to show coral-reefs and wave-washed rocks, teeming with life. Bear in mind again that all these things are for popular education. The naturalist, with his microscope and dissecting knives, with his patient field studies, his camera and note-book, has no need for such artifiicial aids.

LABELS.

The label may seem a very simple matter, but labels have been improved almost as much as cases have. At first they were written slips of paper, often out of sight or illegible and, at most, giving only the Latin name and the locality. Then the English name was added—a concession of pedantry to common sense. But the public wanted to learn something more than the name, so a line or two of information was put in. Now we have the large descriptive label, not written, but printed in clear, bold type, so that it can be read across the case; in effect it is a short popular lecture about the objects shown. It was Dr. Baird, I believe, who said that a public museum should be "a collection of labels with specimens to illustrate them." From one point of view he was right.

METHODS.

The finest exhibits may be spoiled for educational purposes if they are not properly arranged and used in the right way. Here the changes have been well-nigh revolutionary. Naturalists, like other people, make mistakes; like other people, if they are sensible they draw lessons from their own failures. For instance, all the older museums were encumbered with cases which were good in their way, but which, from an educational point of view, were worse than useless; they were there because museum men had not learned to put themselves in other people's places. A naturalist, working for twenty years, perhaps, had accumulated a very fine collection; he was proud



Enlarged model of a Dragon Fly in the Milwaukee Public Museum. By courtesy of the Museum

of it and delighted in showing it to his friends. Nothing seemed more natural than to place the whole on exhibition and so let the public get the benefit of it. But the naturalist forgot that the public could not see with his eyes and appreciate with his mind. He was a trained specialist, delighting in nice points of structure, relations and differences of species, a thousand and one things that the public did not notice at all. He had brought his specimens together one by one, examined and re-examined them until each was an old friend, to be recognized at a glance; he knew that this species was exceedingly rare, that one group was the most complete of its kind in the world and another had been monographed by a master. The public had no such familiarity and, when the specimens were ranged in a case, could see nothing but mass; eye and mind could not take in the details simply because there were so many of them. Now we show only a small part of the collection, species remarkable for beauty or interest, and the tendency is to eliminate more and more.

Naturalists erred, also, in crowding the shelves and so confusing subjects; the simpler an exhibit is the better for its purpose. An ideal case would be devoted to one subject only, having enough specimens to illustrate it, but no more; that is one reason why group cases are so attractive. We can only reach the ideal here and there; but we can group the objects and so keep them from spoiling each other.

It may be a question whether our larger museums do not, sometimes, confuse by trying to do too much, to illustrate too many subjects. We may epitomize geology or zoology in a single text-book, but it is for study, to be digested during several months; the beginner who tried to read it through at a sitting would only find himself bewildered. Naturalists themselves know how hard it is to cover every branch; in our day they are all specialists. Yet a dozen curators, each a specialist in his own department, will unite their exhibits in a single museum, and the average visitor expects to see the whole thing in one afternoon. Of course, this is beyond any man's power; he enjoys two or three rooms, but the feast ends in surfeit and weariness. With more experience he will learn to divide it up; but we ought to make it enjoyable from the first day. It is a

pity that we cannot restrict visits, for the time being, to a part of the museum; sometimes I think that we shall find means of doing so. The visitor would have quite enough to satisfy his mind, he would see more and learn more and would certainly enjoy himself better. The little Post Office Museum at Washington is a gem in its way; personally, I enjoy a visit to it more than I do a walk through the great National Museum. Not that I am particularly interested in post-offices, and I certainly am interested in many things which the larger museum exhibits. But the Post Office collection relates to one subject only—post-offices; with that always in mind, you understand every object and examine it carefully without the slightest fatigue; the hall is like a very entertaining book. I can imagine that each department of the National Museum would be more effective if it were separated from the others by space or time. Quite possibly that may be the next great improvement.

One more feature should be mentioned. Quite often, if a large party or a school class comes to the museum, some curator walks around with it, explaining cases, calling attention to interesting things, perhaps taking out specimens and letting pupils examine them one by one. Of course this adds immensely to the interest, and such little scientific lectures, coming from an expert, are really valuable; besides, the visitors linger about a few cases and really see them instead of catching a hasty glance. Quite recently some museums have employed instructors who are at the service of all visitors; the plan has worked well and, no doubt, will be widely adopted. As for guide-books, those were introduced long ago; but a guide-book cannot answer questions.

Mr. Chapman, of the American Museum of Natural History, told me of a visit from Hellen Keller; she was quite a young girl then, and came with her teacher. Mr. Chapman was showing some birds—I use the word advisedly, for this wonderful child could see in her own way. He took out a bird of paradise—a mounted specimen—and Helen passed her sensitive fingers over the plumage. "It is a crown of glory" she said. Could any description be more graphic?

THE MUSEUM EXTENSION IDEA.

Almost every museum man likes to help other naturalists, and he likes especially to encourage beginners; so another form of museum influence has grown almost spontaneously. For years such work was carried on without any fixed plan, just as occasions offered; even so it was of very real value, and I question whether it has not done more to develop a taste for nature-study than the exhibition rooms themselves. Some one sends a fossil or shell and asks for information about it; the specimen is returned, neatly labeled and probably with a letter of information. The high school has a collection—objects brought in by the pupils—but they are all in confusion and tend rather to discourage than to promote enthusiasm; the museum is appealed to, the collection is arranged and very likely the class gets a free lecture on field work. Some bright boy catches a few butterflies and tries to preserve them; he has an inborn taste for the work but is discouraged because he does not know how to mount and classify his specimens; the naturalist befriends him and a new amateur collection is started. Such things happen every day, and museum curators give more time to them than people would imagine. All this may seem trivial and, in truth, a single case would not be worth mentioning; but a thousand cases, taken collectively, amount to an important movement. This is, indeed, the undercurrent of museum influence, none the less strong because it is unseen.

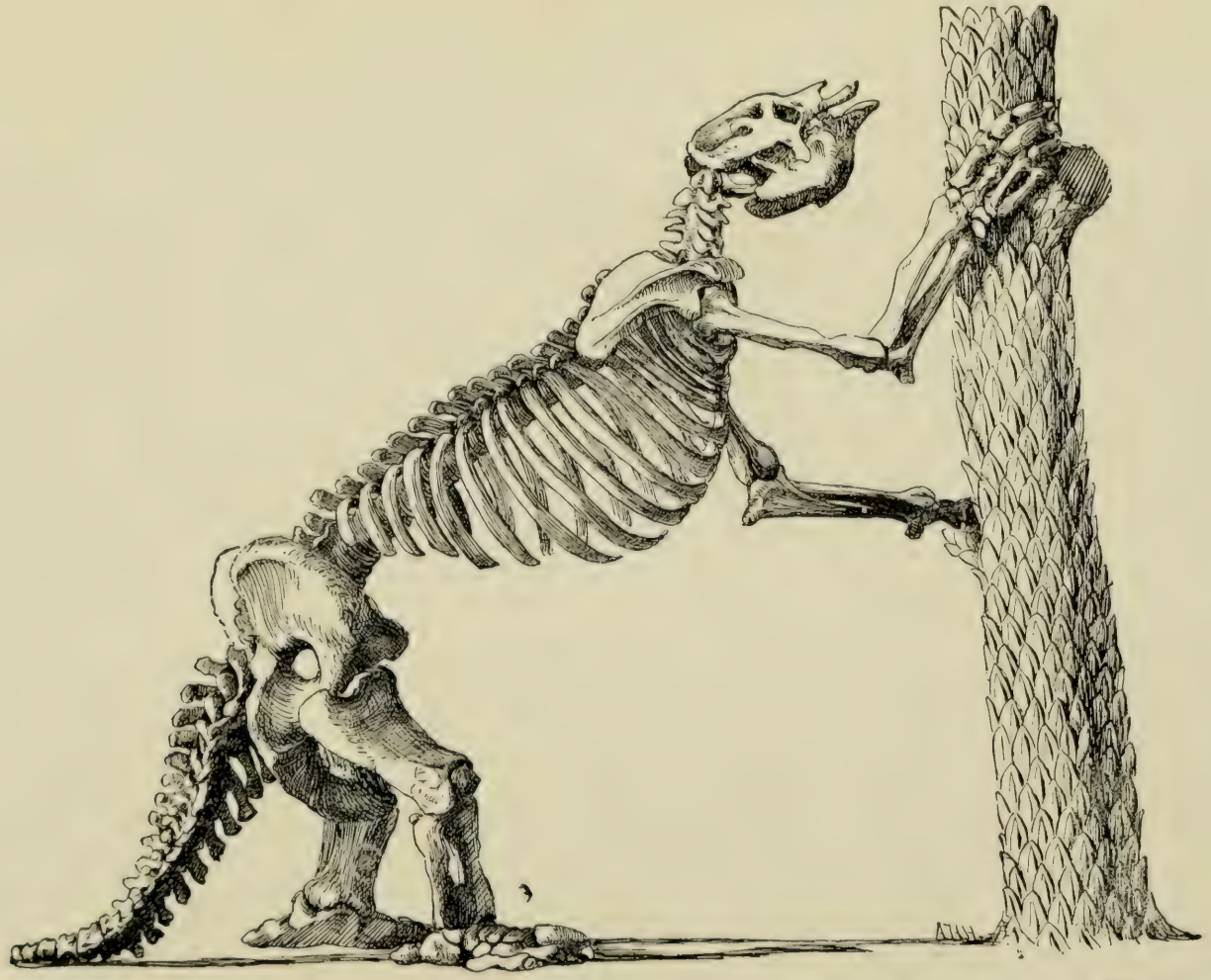
Of late years the outside work has been more or less systematized; in other words, there is a clear effort to carry museum education beyond the museum doors. That the movement is in its infancy we cannot doubt; that it must go through an experimental period and meet with some failures is certain. But its growth has been wonderful. Thirty years ago the American Museum prepared a few loan exhibits—specimens which were lent to schools on application and for limited periods. Other institutions improved on the idea and established regular circulating cases which traveled from school to school; in particular instances collections were even given outright. By this time all the city museums had lecture courses, some for teachers, others for school classes, and the latter might be

in the museum lecture-hall or in the school. The public responded, as it does to generous efforts wisely used. In some cities the interest, coming after years of apathy, was simply astonishing. I saw such an awakening at Pittsburgh; it was so sudden that it surprised everybody and so universal that the very air seemed full of it. School children—some of them the merest tots—were gathering specimens; parents and teachers were enthusiastic; the papers were full of the movement and our museum was beseiged by reporters. Some of the Grammar School and High School boys started a nature-club—the "Andrew Carnegie Society"—meeting in a room which the Museum Trustees opened to them and making weekly collecting excursions. I may tell of that club in another paper; it is enough to say here that it did and is still doing noble work; that it is as enthusiastic as ever, with 250 members and annual meetings where the boys may hear speeches from a governor or two and the governors certainly hear the boys, and learn something, too. Pittsburg teachers "swear by" the Andrew Carnegie Club; it is a feature in the school system and has a regular place in the museum reports.

Our cities recognized the value of museums long ago, and they are recognizing the new departure. The latest and strongest proof of this comes from Chicago; twenty years ago the whole country would have been ringing with it, but twenty years ago nobody would have planned such a thing; the world had not advanced so far. I quote from the Report of the Director of the Field Museum, dated Jan., 1912:—

"The announcemet, late in December, of Mr. Norman W. Harris' important contribution of $250,000 for the extension of the work of the Museum into the public schools of Chicago was greeted by the press and people of the city with marked concert of congratulation. The plans for carrying out Mr. Harris' wishes have not as yet been more than outlined, but the project is receiving the careful deliberation of the director, the curators of the Museum and the officials of the Board of Education. It will take several months to arrive at even a tentative working plan. This rare donation to the cause of education and public welfare will give life and light to the routine of the schools, instill love of nature into the scholars, make for good citizenship and constantly increase the friends and frequenters of the Museum. It is a wise, far-seeing and perpetual benefaction."

Here, in dry, official language, is chronicled an event which



Cast of Skeleton of Megatherium, an extinct sloth-like animal as large as an Elephant
By courtesy of Ward's Natural Science Establishment

means more than a new university and far more than the attainment of the North Pole. It is not only that the gift is the greatest of its kind; it shows that the community has recognized a new force and knows its value; that one philanthropist, at least, is ready to devote a fortune to it. A Chicago man, even a rich and generous one, does not give away a quarter of a million without very good reason. Results are sure to justify the act; they may end in revolutionizing education so far as natural science is concerned.

The key-note of museum extension is helpfulness: we must be ready and eager to aid individuals, schools, communities. More than that, we must advertise our willingness; people hesitate to "take the time" of a curator unless they know that he is there to have his time taken, that it is his duty and pleasure to serve them; metaphorically, the sign "no trouble to show goods" should be posted all over our walls. And it is not enough to encourage those who come to us; we should strive by every means to awaken interest and foster it, until people love nature as we do.

THE MOVEMENT IN THE SOUTH.

Agricultural communities are the last to feel a world-movement. For years, the interest in nature-study has been spreading like a great wave; in Europe, in the Northern and Pacific states, it is seen everywhere; but here in the Southland we hardly know that such a thing exists. It is not that we are less progressive; it is not, in the least, because our people are less intelligent or less appreciative. Taste and aptitude are exactly the same as elsewhere; once awakened they will spring into vigorous life. And the impulse must come from museums just as it has come in other sections. Our people are more or less indifferent now; a few years hence they will wonder at their own indifference. For, in nine cases out of ten, a *community* does not know what it needs until it gets it; a few *individuals* see farther, and they know, and give their lives, perhaps, to supply the need; then people are quick to use the gift and wonder how they did without it. In an isolated region the farmers are apt to oppose a new railroad; but if a few enterprising men put the road through the farmer's crops are moved, the farmer's family

is better off, his children go to school and college, the whole status of life is raised. That is exactly the condition of our states in regard to museums; they see no particular use for them—in a word, are indifferent. Do other communities think as we do? Let the facts speak.

APPRECIATION OF MUSEUMS.

Forty years ago New York had a small natural history museum, supported by the city. It occupied an old armory building in Central Park and was more or less under the control of ward politicians—as far as they cared to control a thing that gave them neither jobs nor votes. However, the place had a curator who did what he could; he saw the importance of large casts of extinct animals and, with some trouble, got an appropriation for making them; an English expert was employed. Of course, his work-room contained a large number of unfinished objects—they had already cost $10,000, I believe. It happened that the modeler was absent when a new park commissioner came along; he saw the littered room and instantly ordered workmen to "clear out this rubbish." That and a few other occurrences of the kind were too much even for New York—and those were the days of Tweed rule, when almost everybody cringed to the "bosses." The American Museum Association was formed, and it bought land outside of the park so that it might be forever free from politicial interference. Its trustees were prominent citizens; the president was a millionaire banker and for years he acted as director. Today this museum is the greatest in America, not even excepting the National; millions of dollars have been expended willingly for popular education, and practically all of it comes from individual donors; the Board of Trustees includes nearly all the multi-millionares of New York. Do hard-headed business men give their time and money to an institution unless they are convinced of its value? And nobody who sees the well-frequented rooms, nobody who watches the crowd of teachers or children going to a lecture, can doubt that they are right.

Mr. Marshall Field was a merchant of Chicago—one of the most successful in the world and the first to plan and carry on

a mail-order system. He gave some million dollars to found the Field Museum—an institution that Chicago is justly proud of. Only a few years before that gift, a Chicago rich man wrote to me:—"Our city has enough to do rebuilding itself after the fire; we have no use for *fossils.*" The last word was underlined to emphasize his scorn of such things. Today the Field Museum has 120,000 fossils on its catalogue and is sending expeditions after more.

Measured by the census, Milwaukee stands in the second rank among American cities. It has a thriving public museum, supported mainly by a special annual tax authorized by the state and city governments and based on a fixed proportion of the assessed valuation of taxable property in the city; at first the limit was fixed at 1-10 of a mill on the dollar, but in 1897 this was raised to 1-7 of a mill; I have no recent figures at hand, but in 1907 the sum thus provided was $28,797. That is, the museum is assured of funds, not only by special appropriations but by special tax, and this by act of the legislature in one of our most progressive states. Nor is the tax a severe one. It does not touch salaries, and poor men really pay nothing.

Having thus substantially shown her appreciation of the Museum, Milwaukee might have folded her hands. But in 1884, when $12,000 was needed to buy a collection, the amount was raised by popular subscription; since then several other collections have been bought in the same way. In his report for 1906-1907 the Director says:—"Donations of specimens and collections have ranged from the bequest of Rudolph J. Nunnemacher of his collection of 1,815 objects, inventoried at $70,030, and of $10,000 for its increase, to the butterfly or dead bird brought in by a primary school child." *

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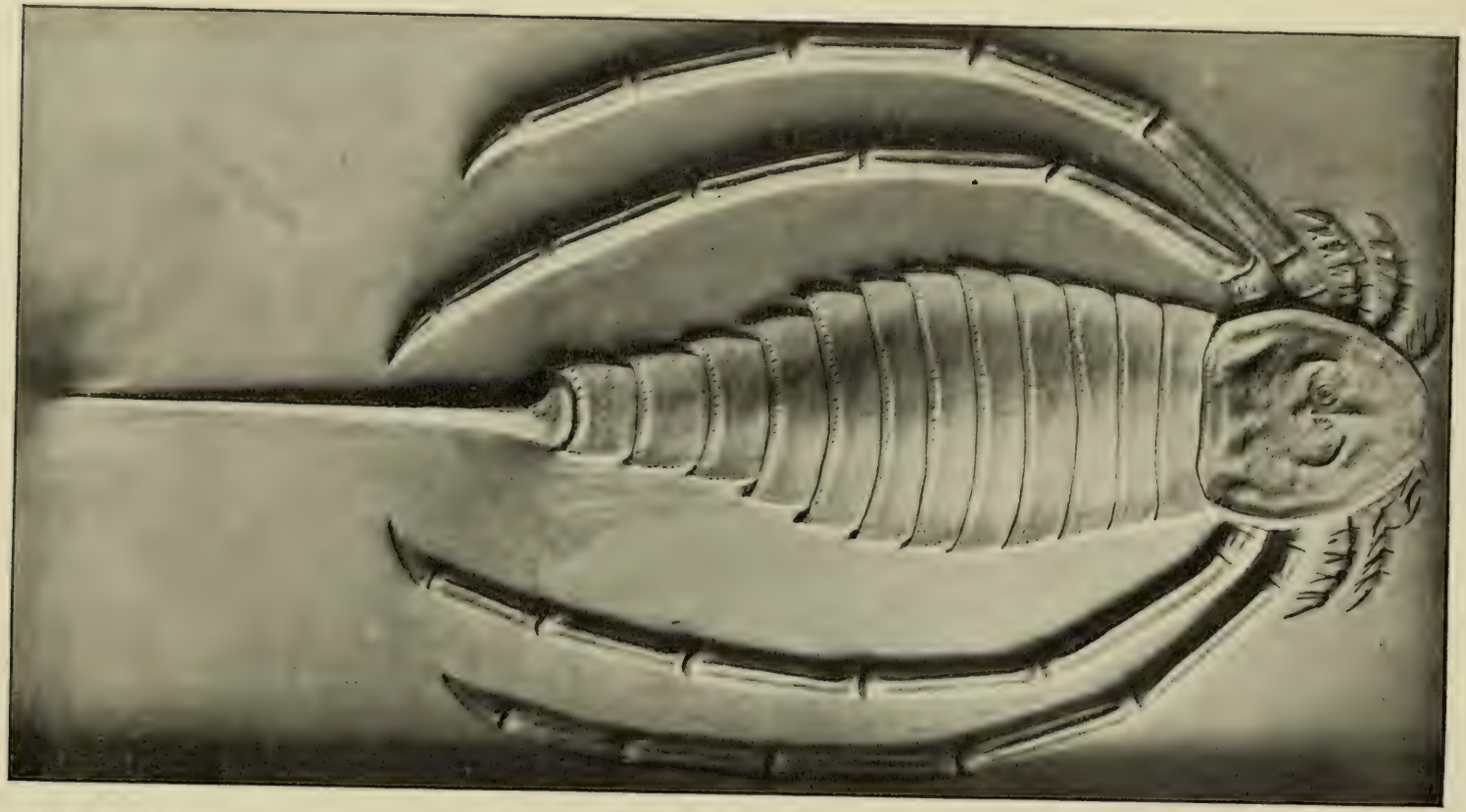
* The Director of the Milwaukee Museum, in a recent letter to the Author, said:—"We are preparing to do a good deal in the way of education; not but what we have been doing a fair amount, but that is small compared with what we intend to do. A few months ago we appointed a Curator of Education, who will come to us in July. By fall we expect our addition to the building to be in commission, with a lecture hall seating something over 750 and one, or perhaps two, smaller lecture halls, so that we are going to push the educational end of our work, reaching the grammar school children, their teachers, high school pupils, various more or less selected groups of the public and the general public. I enclose circulars of our Bird Class and Botany Class."

Granting all that I have urged; granting that museums are vastly improved, that millions have been spent on them, that they do educate the people and educate without weariness; granting that they encourage amateurs and awaken nature-love in our children and give pleasure to thousands and are thoroughly appreciated; there still remains an argument against them so plausible that it has deceived very intelligent people. Consciously or unconsciously, I believe it is in the minds of many when they are urged, as individuals or as legislators, to aid in our work. A thinker may put it something like this:—

"Museums and nature-study are good in their way and satisfy refined tastes; but, after all, they are luxuries; if they mark a high stage of civilization it is because civilization breeds luxury. It would be unwise to tax the community for their support, because the community can do without them very well; only a few people want them and, in strict justice, they themselves should pay for what they get. Those gentlemen in New York and Chicago are wealthy and can afford to gratify their own tastes while giving pleasure to other people; our case is different. In such matters we should be slow in imitating a state like Wisconsin and a city like Milwaukee; some of their ideas are decidedly dangerous."

I frankly beg the gentleman's pardon—he *is* a gentleman—for paraphrasing his objection by putting it into the mouth of—let us say—a "professional" politician. It is necessary for my argument.

"If you fellows want to catch bugs and dig fossils you're welcome to the job; of course *I* think you are cranks, but that's your lookout; you don't hurt *me* any. When you ask me to pay for your rubbish, that's another matter entirely: I'm no such fool. Why, my constituents would kick if I gave a dollar. Those plutocrats up in New York and Chicago can build museums if they want to; I suppose they've got to have some kind of plaything and it may as well be that as anything else; but down here we don't throw away our money so freely. Wisconsin? That's the state where those fool bolters live, aint it? Come to think of it, your Milwaukee had a socialist mayor; no wonder



Model of Stylonurus lacoanus, a gigantic crustacean of the Devonian, as restored by Dr. Beecher
By courtesy of Ward's Natural Science Establishment

they have a museum. That rot about education and nature don't catch me one little bit. *My* boy is going to a sensible school and he'll grow up to be an intelligent citizen like me."

Of course such words refute themselves. But observe that, in substance, they are exactly what the gentleman urged; the difference is in language and manner. If the cad is wrong so is the gentleman; if both are right then all that I have been urging is wrong, and museums and education in nature-lore are not worth striving for.

In point of fact, each *thinks* that he is right, but both are wrong because the reasoning is based on a false premise. Begging the gentleman's pardon again—for he is not conscious of it—he is in very bad company; his is the old plea of ignorance against enlightenment, and a few years hence it will pass into deserved oblivion, like all ignorant thought. It is obselete even now; if our gentleman wishes to be in the fashion he should change his ideas.

We Americans are prone to measure the value of everything in dollars and cents. Well, it has been proved over and over again that science makes the world richer. Geology and mineralogy are indispensable for the mining engineer; entomology is yearly saving immense sums for the farmers and—what is far more important—is teaching us to curb disease by destroying the insects that carry it; our rivers are re-stocked with fish, our oyster-beds preserved, our game and fur animals saved from extinction, all through scientific methods; and so the list might go on for pages. Our captains of industry see this plainly and are employing hundreds of scientific experts; every large metal-plant or foundry has its chemist and every mining enterprise its geologist; nearly all the great wholesale drug houses have herbaria, often very extensive ones, with skilled botanists in charge. To put the argument in a nut-shell, our vast material progress is the direct or indirect result of scientific study. The state gives some money to science and individuals give far more; but if they gave ten times as much they would not be paying a hundredth part of their debt.

Such arguments are unanswerable when urged for the scientific and economic branches of museum work, but they hardly apply to the exhibition rooms or to museum extension. For these

stand on a higher plane; they give something better than money, something more valuable to the man and the state. This, then, was the mistake of gentleman and politician alike; they assumed that nature study and museums give nothing because they do not give in coin.

Education does, indeed, fit us for the struggle of life, but it does more; it makes for a higher civilization, a nobler and happier community. Even money is good only for what it will give, and it cannot give everything or gauge everything. Can you measure in dollars the value of Socrates or Marcus Antoninus or Goethe or Shakespeare? Can you estimate the money worth of the Pantheon, the Sistine Madonna, the Venus de Milo, the Cologne Cathedral? Is a city any the poorer because it pays for a fine building or a public park? Are good books and gems of oratory valueless? Do our young people learn music and dancing merely to turn their accomplishments into dollars?

Because people love literature and art, it does not follow that literature and art are mere luxuries. The world cannot do without them any more than it can do without railroads and schools; in a thousand ways they build up civilization and make us happier. Side by side with these, her sisters, science has been growing and spreading and working for good. With the popularization of natural science has come a love of nature study for its own sake; it is a cult, with an army of votaries all over the world. This is its real value, that it enlarges and ennobles the mind and so makes for a higher and yet higher civilization. The mind so ennobled, has no room for the old, sordid thoughts; the good drives out the bad. If we love beauty in a picture or poem we want it in our daily life; if we have learned to revere truth in nature we shall carry it into business and politics.

A CONCRETE EXAMPLE.

In 1890 the city of Pittsburg was already one of the richest in America. Its people were good-natured, and generous in a lavish fashion; some were men of learning and worth; but, in the main, the community was given over to money-making. The school system was fairly good and there was a struggling university; a few naturalists had united to form a scientific

society, but it barely existed and had no museum; there was no large public library. Rich Pittsburghers, if they could, moved to New York or had winter residences there; they regarded their own city simply as a workshop, a kind of necessary evil.

Soon after this time, through the munificence of Mr. Andrew Carnegie, the Carnegie Institute was opened; it combined a library with an art gallery, a music-hall and a museum. Mrs. Schenley donated land for a large public park, and Mr. Phipps added a splendid conservatory. I have already spoken of the wonderful awakening which followed, but I have not told how it spread to everything and transformed the city. The schools were vastly improved; the university took on new life and had to seek new quarters; popular musical taste rose from dance-hall to orchestra and opera; almost everybody wanted books, and first-class lectures were crowded. More than that, the people suddenly became aware that they owed a duty to each other, and they set their shoulders bravely to a score of needed reforms. Now Pittsburg is a centre of activity in sanitary and tenement work, the fight against tuberculosis, life-saving in the mines and so on; from about the worst governed city in America it has become a fairly good and clean one. Best of all, the people, rich and poor alike, are proud of their own progress and mean to go a great deal farther.

I do not say that all this was owing to the Institute and Schenley Park, but I do say that they were the main influences. One thing about the Institute is well worth noting. In the outset the museum was regarded as a mere adjunct of the art-gallery, of little public importance; only a small part of the general income was devoted to it. But when the halls were opened it was found that the museum drew two people where the pictures attracted one; its rooms were crowded; four or five thousand visitors in a day was no unusual number. From the first, also, it was noticeable that plain people, professional and business men, workmen and their families, gravitated to the museum rooms; fashion was there, but, in the main, society folk preferred the art-rooms. Naturally, there was a small struggle for control of the funds; it ended in an equal division between the two departments. Today, I believe, the masses have a better appreciation of art; but, on the other hand, science has plenty of votaries in the society clique.

OTHER ASPECTS OF NATURE STUDY.

One other aspect of nature study should be mentioned. Education is not a mere accumulation of facts; it is, or should be, a training. Mathematics are valuable partly because they give keenness and precision, history because it tells us how to reason from events, art because it cultivates the sense of beauty, and so on. Natural history trains our powers of observation as nothing else can, and it teaches us to reason from the known to the unknown, to classify and distinguish—an ability of more value than a thousand mere facts.

It should be remembered, also, that nature-study is a healthful pursuit, giving plenty of exercise in the open air, under the best conditions and with keen interest to keep the mind awake. Naturalists are healthy men and they are almost proverbially long-lived. I remember a remark of Col. Nicholas Pike—soldier, civil-service worker, traveler and naturalist. At the age of 75 he was just starting on a walk of 200 miles with his wife, a lady nearly as old and quite as enthusiastic as he was. I begged them not to attempt too much, but Col. Pike only laughed. "Why, my tramps keep me healthy," he said; "I should have died long ago without them."

THE MUSEUM OF THE GEOLOGICAL SURVEY.

The Museum of the Alabama Geological Survey stands in a peculiar position. An outcome of the Survey, it is, by law, an integral part of the University of Alabama; its building, the finest museum edifice in the South, was erected at the cost of the State; its collections, unexcelled south of the Ohio, are largely derived from the Survey, but with important additions from other sources and from its own work. Its relations, its objects and its duties are therefore complex. It is, at the same time, a survey museum, the home and workshops of survey men, a university museum, bound to do its part in university education, and a state museum, with obligations to the entire commonwealth. At present it has no funds of its own, but is supported mainly by the Survey, the University defraying certain expenses.

The great museums are in large cities and hundreds or

Igarot Pottery Makers, Philippine Islands. Field Museum, Chicago. By courtesy of the Director

thousands of people visit them every day; they have rich endowments or wealthy patrons and can afford to do their work on a magnificent scale. Our building is on the University campus, near a small city; the educational work of our exhibition rooms extends to the students, the citizens of Tuscaloosa who come often, and outsiders who come at infrequent intervals. Manifestly, it would be absurd for us to attempt rivalry with the American, Field or Carnegie Museums, or the Public Museum of Milwaukee; if we could afford them, we would be foolish to show twenty-thousand-dollar group cases or long series of huge fossils obtained by special and expensive expeditions. But it is no less manifest that we should be efficient in our special work for the University. To do this we should spend thousands where the great museums spend millions, and have a few things where they have a great many. As a matter of fact, our rooms are constantly improving, though they are yet far from what we hope to make them; many of the cases are arranged for convenient reference rather than as object lessons. The most urgent needs for these rooms are some large casts, a series of glass models, two or three group cases of birds, and table-cases for the better exhibition of small specimens; all these can be obtained for a few thousand dollars, and we may reasonably hope to have them before long.

So much for the exhibition rooms; but in the other branch of work we accept no such minor position; the youngest of American museums this is, perhaps, the most ambitious. The great city museums are doing first-rate extension work, but, so far, it is confined to the cities themselves and their immediate vicinities. We believe that ours is the first definite attempt to extend museum influence over an entire state. The truth is, our situation made such work imperative; we could not reach a large number of people through our exhibition rooms and had to do it in some other way.

Our first move was to reach the public schools. Every museum has duplicate specimens, which may be used for exchange, but most of them are never used at all. We had a very large number of fine duplicates and we planned to give some of them to high schools and similar institutions. Such schools often have small collections, generally bought from dealers;

but, almost always, the specimens are inferior and there are not enough to illustrate even the main groups. From the first, we determined to give large and fine sets, carefully labeled and classified. This meant the selection and arrangement of many thousand specimens for each school, and the whole had to be done in the intervals of regular museum work; of course such a task could not be accomplished in one year, or two. The plan, therefore, was to make the gift by instalments, to go on from year to year indefinitely, and to issue such sets to 25 schools. Each instalment was to represent, as far as possible, one group. Each specimen was to be numbered to correspond with its label, so that, if they were accidentally separated, they could easily be brought together again even by an unskilled person.

The first instalment sent out consisted of marine univalve shells, 159 species, represented by about 500 specimens, for each school. The specimens were fine, and such a series, if purchased of a dealer, would have cost about $150 at a conservative estimate; that is, for the 25 schools, the specimens alone of this first instalment had a money value of $3,750. Each species had a printed label, and there were 36 large explanatory labels corresponding to the orders and families. The specimens were in neat trays; each label was glued to a sloping block slipping into the tray, so that the whole was ready for exhibition. A printed pamphlet gave directions for arrangement.

Schools accepting a collection agreed to pay for transportation and to provide proper cabinets or cases; the Museum defrayed the cost of trays, labels, etc., for the first instalment of specimens, but the schools agreed to pay, at cost price, for such outside material required in future. As long as these conditions are fulfilled the collection is the property of the school, but subject to the general supervision and control of the Museum, and it cannot be sold or given away without the consent of the Museum Director. If conditions are violated by the school the collection may be reclaimed.

It should be remembered that marine gastropods—the only group included in the first instalment—are only a part of the mollusca; there remain the bivalves, all the land and fresh water shells and the cephalopods, and we propose to give special

and fuller sets of the Alabama species. But conchology is only one branch; we expect to include insects, crustacea, corals, echinoderms, at least some birds and other vertebrates, and probably plants. Geology will have a prominent place; there will be specimens of rocks, ores, minerals, fossils, etc.; probably the second instalment will consist of Alabama fossils. In fact, we are planning for 25 branch museums, to be built up gradually in widely separated parts of Alabama.

The schools have been chosen with care, for their importance and also to distribute the collections as evenly as possible. Private and denominational institutions were excluded, though several are of great merit; we felt that our duty lay to the public ones. The normal schools are to receive special sets later on. From first to last there has been no hint of favoritism; we have simply tried to place the coilections where they would do the most good.

The reception of our gifts was gratifying. Teachers were enthusiastic in their praise; local newspapers were quick to see the advantages accruing to their towns and schools, and they gave a good deal of space to the plan, already widely heralded by the more important city journals. Of course there were exceptions; some schools were indifferent; some declined the gift; two or three did not even take the trouble to send an answer to our offer; one principal wrote that it would be unjust to make his school pay for a cabinet. Every new scheme must expect such rebuffs, but we had very few; approval was clear, and there was an immediate awakening of interest all over the state. This was shown by numerous letters, including not a few from schools which begged for a share in the distribution. Latterly these requests have become so numerous that we have decided to issue additional sets as soon as possible.

The next step was to make these gifts permanently useful. A school collection may serve to illustrate lectures and lessons, but it will not arouse enthusiasm until the pupils themselves are interested in building it up. At our suggestion, most of the schools have pupil custodians, chosen by vote. The custodian has charge of the collection and is expected to add to it by specimens which he or his comrades may find; he corresponds with the Curator of this Museum, who tries, by every

means, to promote taste for nature study. Of course the influence cannot be felt in a day, nor is the plan always successful; but the results in many cases have been more than encouraging. Some of these custodians are already enthusiastic amateur naturalists and their comrades catch the spirit from them; in several schools the pupils are adding almost daily to their museum and have an evident pride in it.

These school museums are seen by many parents and other outsiders; but the larger cities should have public museums, where the exhibition rooms will be really educative. We are already planning branches for Montgomery, Birmingham and Mobile. In the latter city we are working in conjunction with the Charles Mohr Society, a thriving and enthusiastic circle of naturalists; collections have been formed and arranged, and the Society is building up a working library. At present the specimens are in very modest quarters and have only been shown on a few occasions; negotiations are in progress for their transfer to a public institution, and it is probable that Mobile will soon have a good public museum.

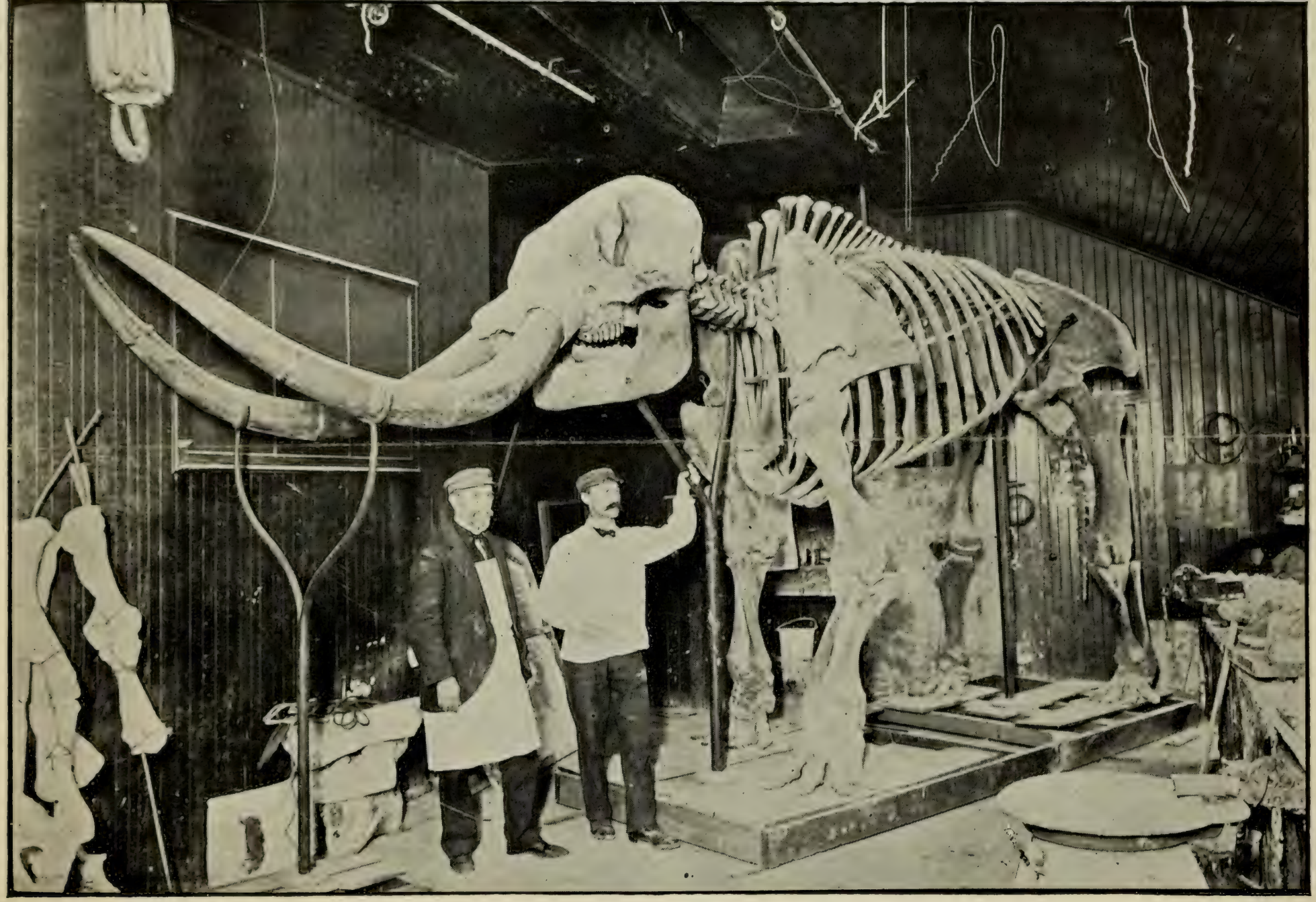
Meanwhile, we are not forgetting the undercurrent—personal aid and influence. Ours is missionary work and we must make our opportunities, helping not only those who come to us, but seeking them out, cultivating every promising field. At the University, students are invited to our laboratories and encouraged to do practical work in the field. Arrangements have been made to meet some of the custodians in a camping and collecting trip. More than one amateur traces his interest to us. It is clear that the awakening has come for Alabama; the increase of interest is manifest and growing all over the state. Nature study is here and it is here to stay.

Large museums count their income in five or six figures; even small towns are spending generous sums, because they are convinced of the value of museum work. Until now the resources of the Survey Museum—which is really the State Museum of Natural Science—have been absurdly inadequate for the task. It is the simple truth that our plans are more far-reaching than those of any similar institution, and they have met with marked success. To make them complete we should have some improvements in the museum itself, and closer and

Group Case of Marsh Birds in the Milwaukee Public Museum. By courtesy of the Museum

more effective relations with the schools. For example, we should be able to give school lectures with stereopticon illustrations, and there should be regular field excursions under our supervision; but at present we cannot carry out the plans because we have no funds.

It would be unjust and, indeed, illegal to burden the Geological Survey with the expenses of such outside work. It would be equally unjust to throw the burden on the University; it needs all its resources, and more, for other things. It seems clear to me that the Museum should have an endowment of its own. Until this can be secured it should receive a sufficient special appropriation from the state, as other state museums do. I am not claiming that museums are the most important of public institutions, but I do hold, and think I have proved, that they are one of the strongest influences for good; that they educate the people and make for a higher civilization. Our own Museum, perhaps, is doing more than its share; certainly it deserves support and encouragement.



Mastodan Skeleton Mounted in the Work-shop. By courtesy of Ward's Natural Science Establishment

MUSEUM OF THE GEOLOGICAL SURVEY OF ALABAMA

DIRECTIONS FOR COLLECTING LAND SHELLS

The land shells, commonly called snails, have long been favorites with conchologists. They have a special interest in the study of geographical distribution, serving, perhaps, better than any other animals to mark zoological provinces and sub-provinces. This is because they cannot fly nor swim and, being sluggish in their movements, cannot easily extend their range. Many of those found on islands are peculiar, and this is also true of mountain groups and even valleys and plains. Some kinds are found over large areas while others are exceedingly local.

For many years American naturalists have been studying our species with special reference to their distribution. The Museum of the Geological Survey has undertaken to carry out this work in Alabama, and therefore wants collections, as complete as possible, from each county. We also propose to publish a catalogue or monograph of the Alabama species, and any additions to the known list will be especially valuable in connection with this work. Such a book is very much needed, especially by beginners; as it is, they are discouraged by the difficulty and expense of getting the necessary literature. Yet the collection and study of land shells is one of the most fascinating branches of natural history and it can be carried on, during leisure hours, by almost any one.

To increase the Museum collection in this branch we ask the cooperation of all our friends, and especially of teachers; by encouraging their pupils to collect shells they can aid us materially and, at the same time, promote a taste for nature study. Young people, especially boys, like the work and often become very proficient.

About 135 species of snails are known to live in Alabama and almost every year brings additions to the list. Careful collections from any one county will give from fifty to eighty species. Some kinds range all over the state and beyond, but

others are confined to particular districts, such as the "Black Belt," the coves of the northern plateaux or the coast region. Some of the rarest and most desirable are known only from one or two places.

Comparatively few species are over an inch in diameter; others are of medium size, and many very small. These tiny things are most valuable of all, and much more likely to be rare or new. If the amateur carries a pocket lens he will add greatly to his pleasure by examining the small shells, many of which are very beautiful.

The collector should take care to label every lot of shells with the locality; this is of the utmost importance and should never be neglected, even for a day. The label may state the mountain, valley or cove where the things were gathered, or the nearest town, and always the county; the collector's name should be added.

Samples of labels are given below:—

Lookout Mountain, near Valley Head,
DeKalb Co., Ala.
John Jones, Nov., 1912.

Near Wetumpka, Elmore Co., Ala.
William Brown, Collector.

Banks of Warrior River,
Holt, Tuscaloosa Co., Ala.
James Allen.

A label should be placed in each box of specimens and, as an additional precaution, it may be written on the lid. Never mix specimens from two counties and never label a lot unless you are SURE of the locality; a false or doubtful label is far worse than none at all. Occasionally, rare or desirable things may be preserved with approximate or probable locality; for instance, "Central Alabama," or "Probably from near Montgomery." But such labels should be avoided as much as possible.

Dead shells are generally useless, but may be preserved if they are fresh and retain their color.

The collector requires no apparatus except a few boxes of different sizes, which can be carried in the pocket or in a belt bag. Do not use metal cans or glass bottles; pill boxes are best for small things and thread boxes, flat wooden boxes or wooden pill boxes for larger species. A pair of fine-pointed forceps for picking up small shells is convenient, though not indispensable; it should be attached to the button-hole by a string to prevent loss. In collecting, put small shells in one box and large ones in another; it is also well to separate the large kinds, keeping those with thin edges in a different box, as they may be broken if left with the heavier ones.

Most snails are nocturnal, concealing themselves during the day; it is the collector's task to find their hiding places. Generally speaking, there are few or none on cultivated land or in pine woods or about pine lumber. The most productive places are shady, damp woods of hardwood trees, especially on steep hillsides, in ravines and along river banks. In such places turn over logs and sticks, looking on the lower side and on the ground beneath. With a stick rake over damp, decaying leaves, especially about rocks and logs and at the roots of trees and under bushes; small shells may be found among the leaves and larger ones on the ground beneath. It should be noted, however, that dry or very wet leaves are unproductive. Piles of half rotten brush may shelter large numbers of snails; drag away the brush and rake the leaves underneath. An old wood pile may be a treasure house and will often repay removal, stick by stick. The cut ends of such wood, as well as of hardwood logs which are beginning to decay, sometimes attract small species, or they may be found in crevices of the bark or under fungi growing on the wood. Loose bark should be stripped off to examine its inner surface and the rotting wood beneath; in some cases the latter should be broken up to uncover the species which hide in its crevices. Turn over stones and look at the lower surface and the sides; piles of stones and talus under a cliff are particularly good, especially if they are damp and moss-covered.

Boggy ground has its own species, which should be sought for at the roots of grass and under logs or brush; trees growing in such places often have small species in crevices of the bark,

especially near the roots. The delicate SUCCINEAS conceal themselves among grass and leaves and may often be found crawling up the grass stalks at nightfall.

Examine very shady and damp ground near streams; some of the very small, elongate species live in such places and may be found crawling over the surface or on and under stones.

Though plowed land is unproductive, lawns, vacant lots and the edges of fields may be very good; stones and rubbish should be searched, boards turned over and piles of weed, sticks or chips raked out. Shell-making snails require lime and are attracted by anything containing it, not only limestone, but old mussel or oyster shells, etc.; an old lime-kiln is pretty sure to be populated, and piles of old bricks with the mortar adhering are almost as good. Search along damp stone and brick walls and on the shady side of barns. A good many shells may be found under vines and blackberry bushes.

Forest on the flood-plains of rivers and creeks is often very rich in shells, but they should be sought for principally along the edges of the plains or where the ground is a little higher and less exposed to the floods. Piles of driftwood should be examined, and also the fine silt left by the highest freshets.

Open and dry land is generally poor hunting ground; but exceptions may be found on stony ledges and tops of cliffs. A few rare species live at the roots of grass in glades of the pine forest. In the flat southern pine forests there are often slightly lower places which are grassy and have few trees; several kinds of snails are found in such places, in the grass or under logs. On these grassy lands and elsewhere the presence of snails may often be detected by finding dead shells on the surface, the living ones being concealed near by. Near the seashore the most productive places are grass-land and woods just back of the sands, and many of the shore species do not range far inland.

In Alabama land shells may be found at any time, but spring and late fall are the best seasons.

Winter collecting is apt to be productive in the smaller species, which then gather under bark, stones and rubbish, and often under dried cakes of cowdung in a pasture. Some of the

minute kind cover themselves with clay, so that it is difficult to detect them.

Damp or wet weather brings the snails out; after a heavy rain it is often possible to gather hundreds of specimens where hardly any were seen before. At such times they crawl over the wet rocks and logs, and on tree trunks, cedars being especially good.

The collector may occasionally find places where small shells are very abundant among the rotting leaves; they may then be collected in quantity with a sieve. Use a flour-sieve with moderately coarse meshes, and have a white cloth to spread beneath it. Shake and crush the leaves in the sieve and the small shells will fall through, together with sand and fine rubbish; pour these siftings into a box and repeat the process as often as desirable. The siftings, after drying, may be sent to us as they are; this is better than an attempt to pick out the small shells, which would be tedious and difficult for a beginner. Another and often better way is to take home a large bagfull of the leaves, dry and then sift; more specimens are obtained, as they are more easily detached from the dry leaves. Sifting is one of the best means of obtaining our minute species, and it can also be used with silt, moss, or any decaying rubbish.

Do not be afraid of getting too many of a kind; we want a good many anyway, and the tyro might easily mistake two or three species for one, thus losing valuable things. The best rule is to keep right on collecting, no matter whether the shells are common or not; but do not do too much work in one spot. A slight change in the collecting place—even a few yards—often adds other species to the "catch."

Snail shells have to be cleaned and the animals of the larger ones extracted before they are placed in the cabinet. This work requires some practice and can hardly be undertaken by a beginner. Fortunately, the snails can be sent to us alive, just as they are collected, and this involves no suffering to the animals, as many of them can live for weeks without food.

Put small ones, all together, in the bottom of a pill box and fill the box, rather loosely, with cotton—enough to prevent

shaking without much pressure. Pack large ones in spool boxes in the same way. Hairy shells may be covered with tissue paper instead of cotton, as the latter sticks to them. Each box should have a locality label inside, and this may also be written on the lid. If covers are loose, tie the box with string or wrap it in paper.

The boxes, large and small together, should be packed in cigar boxes with cotton or fine excelsior all around them. They can then be sent safely by mail or express.

If desired, a set of the species will be cleaned, named and returned to the collector; in fact, we shall be very glad to aid him in building up a collection of his own.

DIRECTIONS FOR COLLECTING THE FRESH WATER SHELLS CALLED PENNIWINKLES

This family (Pleuroceratidæ of conchologists) is confined to North America, and by far the greater number of species to Alabama, Georgia, Tennessee and North and South Carolina. In this region the number of species and varieties is astonishing; over four hundred have been named and as many more remain to be described. Each species has a very limited range, sometimes in one river or creek or even a small branch; in a river a species may be found on only one or two shoals. A whole genus, with nearly forty species, is confined to the lower Coosa, and there are other similar cases. It is therefore of the utmost importance to have collections from all streams where these snails are found, even the merest brooks. It is essential to get them now, because many species are disappearing; ducks may destroy those in the small streams, and dams, by deepening water on shoals, may make a river bed unsuitable for the snails which have lived on it.

The museum of the Alabama Geological Survey has one of the largest collections of Pluroceratidæ in the world, yet it is far from complete. Half of our smaller streams and many rivers and creeks have never been searched at all; others are known imperfectly. We are especially anxious to increase our collections in this group, because the Curator is studying it with a view to publication.

Any one can aid in the work with very little trouble, and any collector may obtain not only rare but unknown species. We therefore invite the cooperation of all friends of the Museum.

If desired, named zoological or geological specimens will be sent in exchange for penniwinkles. A named set of the latter may also be returned, but this cannot be done at once, because the species can only be worked out by long and careful study.

Penniwinkles are found in running water, some on rocks, others on mud or sand, some where the current is gentle and others where it is strong, even in the rush of river-shoals. In most cases they can easily be seen from the banks or detected

by their tracks on the muddy bottom. In river shoals some of the best kinds will be found on the lower surface of stones. A log or board in the water is often covered with them, both on top and underneath. When rivers and creeks are at their lowest, many will be found in pools along the sides, where they have been left by the retreating waters.

In most cases comparatively few can be obtained from the banks; the collector, to do good work, should wade in the shallows, and this is all the more important because some kinds keep to the middle of the stream while others may be found near the shores. A small bag attached to the belt is very convenient for collecting. If the collector gathers mussels and penniwinkles at the same time, it is well to have two bags, a large one, slung from the shoulder, for the mussels and a belt-bag for the penniwinkles, which would have their edges broken if put with the heavier shells. Most of the mud may be rinsed off, but no attempt should be made to clean the surface of the shells thoroughly; this is done later, when they are prepared for study.

Great care should be taken not to mix specimens from two creeks or from two localities in the same creek or river. Each lot should have a plainly written label giving the locality (name of river or creek and place where the things were gathered) with the collector's name.

Put the penniwinkles in boiling water and leave for about a minute; but do NOT put in cold water and then boil. The boiling water kills the animals quickly. Pour off the water and let the shells drain and dry a little on a board. Then spread on the bottom of a flat covered box, such as a shirt box, and dry for several days. The covered box may be placed in the sun, but the uncovered shells should not be exposed to sunshine. It is necessary, on account of the unpleasant odor, to keep the box in a barn, or some other place away from living-rooms. After a few days, pack the shells with good, clean sawdust, in cigar boxes. There should be five or six times as much sawdust as shells. First put a rather thick layer of sawdust on the bottom of the box, pressing it down; spread shells over this and cover with sawdust, again pressing down and

shaking. Continue this until all are in. Fill up the box with sawdust, shaking and pressing repeatedly; close the lid and strike the box sharply on each end and side; then open and fill in any vacant space. Finally, put the locality label in the top of the box, close and nail, or tie it up and write the locality on the outside. The box so packed should go on drying until it is sent to the Museum; the sawdust assists in the drying process and the closed box is not likely to give out any unpleasant odor. Several labeled cigar boxes may be packed in a larger box, with excelsior, and sent by express at our expense; or, a single box, if thoroughly dried, may be sent by mail.

Large numbers of the shells should be collected when possible; four or five hundred from one locality is not too many. This is all the more important because it is nearly impossible to distinguish the species until they are cleaned; though all the specimens of a lot may look alike, they may, and often do, include several kinds. The larger the collections the greater is the chance of rare species.

It is a mistake to collect only in part of a stream; each species has its haunt and places even a short distance apart may have quite different assemblages of shells.

DIRECTIONS FOR COLLECTING MUSSEL SHELLS

The Museum of the Geological Survey is making a collection of the fresh water mussels of Alabama. The objects are, first, to bring together all the species found within the state limits, second, to find the range of each species—that is, the rivers, creeks or lakes which it inhabits. Each kind has its special range, which may be extensive, covering many states, or limited to a single stream. By making tables of geographical distribution we are able to trace zoological provinces and sub-provinces. For this reason we wish to have collections, as complete as possible, from every river, creek and pond in the state. Alabama has more species of mussels than any other region of its size in the world; about 300 are already known and there are still others to be found and described.

The Museum will be grateful for assistance in this work;

it is very easy, can be carried on by any intelligent man or boy, and valuable collections may be made in almost any part of the state. Full credit will be given to the collector in our publications and catalogues. If desired, we will send, in exchange, shells, fossils and other specimens, all correctly labelled. In this way it is possible for a teacher to build up a collection for his school, or for an amateur to start a collection of his own. If a teacher does not wish to get the things himself he can generally induce his boy pupils to do so. In some cases a colored man or boy may be employed to advantage.

Where mussels are found at all they are generally most abundant on gravely or rocky shoals and in moderately swift current. Good localities may often be detected by finding dead specimens on the banks. These dead shells are useless unless they are fresh and perfect. To make really good collections the live ones should be sought, and this is best done by wading when the water is low and clear. If much wading is done the feet may be protected with canvas tennis shoes or the so-called running shoes; these will last a long time, even when constantly wet, and they can be used for walking as well as wading.

Wade slowly UP the stream, scanning the bottom, especially in gravely places and crevices between rocks. The mussels can often be seen buried in the gravel with only the mouth or part of the shell out. Where, on account of the current or muddy water, they cannot be seen, they can be found by feeling with the hands. A hooked stick or small pick is useful for digging up the gravel. Many species are found under flat stones—the larger the stones the better—and others along the banks, under overhanging roots and sod, where they must be felt for with the hands. Some kinds, especially those with thin shells, live in still water, such as mill-ponds; when such a pond is drained for any purpose it will often yield a rich harvest of mussels and other shells. Deep-water species are more difficult to obtain, but are sometimes brought up by dredges or nets. When locks are drained for cleaning their floors should be examined, especially close to the side walls. In any river or pond mussels may be abundant in some places but rare or wanting in others.

Though old dead shells are useless, fresh ones, with both valves, are often good. Frequently piles of these are accumulated by muskrats on rocks or logs or along the shore. If such shells are dry they should be soaked for some time, then washed, and the valves closed slowly and carefully to prevent breaking the hinge. Often the best of these muskrat deposits are in the water about the burrows; In such cases the old, discolored shells should be rejected and only the fresh ones saved. But muddy shells are often the best, as the mud protects the surface and can easily be washed off.

Some of our species are large and heavy, others large but thin-shelled, others small, even less than an inch long. These small things are especially desirable.

It is very important to have the exact locality of each lot of mussels; in fact, collections are useless without them. Never mix specimens from two rivers or creeks and never leave them unlabeled. Labels should be plainly written with pen or pencil, and on good writing paper. They should give the name of the river, creek or lake, and the collector, thus:—

Buck Creek, Shelby Co., Ala.
John Smith, Collector.
July, 1912.
or
Bird Spring Lake,
10 miles south of Huntsville, Ala.
William Jones, Collector.

If the collections are made in large rivers the label should give the name of the shoal, some town in the vicinity, or, at least, the county, thus;—

Coosa River, Fort Williams Shoals,
Shelby Co., Ala.
or
Alabama River, near Selma.

It is easy to kill and clean mussels. First wash off the mud, using a small scrubbing brush. Have a pail or pot of boiling water over the fire; drop the mussels in and they will die instantly. Leave them until the shells open; then take them out or pour off the water and remove the animals, scraping away any flesh that may remain. If any shells do not

open, pass a sharp knife between the valves. Never put mussels in cold water and THEN boil; this would be cruel and, besides, does not effect the purpose so well. Rinse the shell in clean water, and it is well to dry the inside with a rag. Hold it so that the valves are closed, and wind tightly with string or ball cotton, about four times round; no matter what shape the shell is, the string should be wound over the hinge and far enough back so that it will not slip. Tie securely on the edge opposite to the hinge.

It is generally better to clean and tie up mussels when they are collected, and for this purpose the collector may carry a tin pail for boiling, small scrubbing brush, string and scissors, and a pencil and paper for labeling. A canvas bag with a strap to go over the shoulder is convenient for collecting, though any bag or basket will serve. Do not be afraid of getting too many of a kind; a hundred of one species from one locality is not too many. Besides, many of the species resemble each other closely, and a supposed single species may include several.

If large numbers of mussels are collected in one locality, they may be packed in layers with excelsior, the smaller and light things in cigar boxes which can be packed with the other shells in the larger box. Each box, large or small, should have a locality label inside, and the locality may also be marked on the box lid. If only a few specimens are to be packed, each can be wrapped separately in paper and the lot put in a cigar box with excelsior. If excelsior cannot be obtained, use hay or crumpled paper. Never send shells loose in a box, as they would be broken or injured. In packing, see that the box is quite full and pressed down. Small boxes from one locality, if properly labeled, may be packed with shells from another locality. Send all large boxes by express at the charge of this museum; small ones may go by mail. Address:—

MUSEUM OF THE GEOLOGICAL SURVEY,
Tuscaloosa, Alabama.

Letters relating to the collection should be addressed to

HERBERT H. SMITH,
Curator of Museum,
University, Ala.

GEOLOGICAL SURVEY OF ALABAMA
EUGENE ALLEN SMITH, *State Geologist*

MUSEUM PAPER NO. 4
ALABAMA MUSEUM OF NATURAL HISTORY

ANNOTATED LIST OF THE AVERY BIRD COLLECTION IN THE ALABAMA MUSEUM OF NATURAL HISTORY

(GEOLOGICAL SURVEY MUSEUM)

BY
ERNEST G. HOLT

Biographical Sketch of Dr. William Cushman Avery
by his sister
MISS MARY E. AVERY

UNIVERSITY, ALABAMA
1921

THE BROWN PRINTING COMPANY
MONTGOMERY, ALA.
1921

WILLIAM CUSHMAN AVERY, M. D.

GEOLOGICAL SURVEY OF ALABAMA

EUGENE ALLEN SMITH, *State Geologist*

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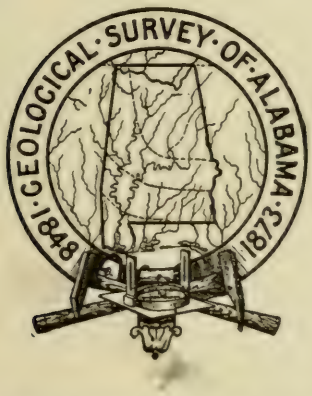

UNIVERSITY, ALABAMA

1921

PRESS
BROWN PRINTING CO.
MONTGOMERY
ALABAMA

LETTER OF TRANSMITTAL.

To His Excellency,
Governor Thomas E. Kilby,
Montgomery, Alabama.

Sir: I have the honor to transmit herewith the manuscript of an annotated list of the Avery bird collection, with the request that it be printed as Museum Paper No. 4 of the Alabama Museum of Natural History, (Geological Survey Museum).

Very respectfully,

EUGENE A. SMITH,
State Geologist.

University of Alabama,
September, 1921.

GEOLOGICAL CORPS.

Eugene Allen Smith, Ph.D. ..... State Geologist
William F. Prouty, Ph.D.
George I. Adams, D.Sc. } Assistant Geologists on Special Work.
George H. Clark, C. E.
Robert S. Hodges ..... Chemist
Roland M. Harper, Ph.D. ..... Geographer and Botanist
Mrs. Herbert H. Smith ..... Acting Curator of Museum
Truman H. Aldrich ..... Honorary Curator of Mollusca
Rev. H. E. Wheeler ..... Assistant in Paleontological Work
George N. Brewer ..... Field Assistant
A. T. Donoho ..... Secretary

RIVER GAGE HEIGHT OBSERVERS.

Tallapoosa River at Sturdevant, Ala.

A. L. Stow ..... Alexander City, Ala.

Elk River at Elkmont, Ala.

Dr. William E. Maples ..... Elkmont, Ala.

Observations are made every day by these observers of the gage readings at the several stations. From these records when extended through sufficient time, the calculation of available horse power to be obtained from the different streams is made.

PREFACE.

THE act of the legislature of Alabama, approved April 18, 1873, "To revive and complete the geological and agricultural survey of Alabama," has from the first been construed to include, as related to agriculture and therefore legitimately a part of the survey work, the investigation of the fauna and flora of the State. In the preface of my first report, 1874, I have outlined the scope of a complete report of this survey to include,

I. Physical Geography.
II. Geology and Paleontology.
III. Economic Geology.
IV. Agricultural Relations, and
V. Botany and Zoology,

and the reports of the Survey from year to year have covered more or less in detail all of these subjects.

Collections of the native plants of this State, begun in 1873 and continued since, have resulted in the accumulation of a fairly complete herbarium of the plants growing without cultivation in Alabama, and the publication of the classical work of Dr. Charles Mohr "The Plant Life of Alabama." Additional notes on the flora of the State have been published in most of the Survey reports up to the present time.

Naturally the insects injurious to vegetation and the birds and other animals which prey upon them, or which are themselves directly destructive of vegetation, must be considered in any reasonably complete account of the agricultural features of the State.

In my report for 1875 was published a preliminary paper on the cotton worm by Prof. A. R. Grote, and in the 1876 report, A Preliminary List of the Fresh Water Shells of the State, by Mr. James Lewis.

We have now in manuscript ready for publication, a similar list of the Reptiles and Batrachians of Alabama by H. P. Loding of Mobile, and the present report con-

tains a list of the collection of Birds of Alabama made by Dr. William C. Avery and now in the State museum, together with all his ornithological notes.

This is preliminary to a complete account of the birds of the State, which we hope in due time to present.

A similar report on the mammals of the State and on the insects, especially those injurious to vegetation, should follow in due course, but the overwhelming number of insect forms existing at the present day, makes a complete presentation of the insect life even of a state, a life work. We may hope, however, soon to make at least an initial report on the most important insect forms in their relation to agriculture.

EUGENE A. SMITH.

BIOGRAPHICAL SKETCH OF WILLIAM CUSHMAN AVERY.

Condensed from notes by his sister Miss Mary E. Avery.

WILLIAM CUSHMAN AVERY, M. D., son of Rev. John Avery, D. D., and Ann Paine, his wife, was born in Edenton, N. C., Sept. 21, 1831.

From his earliest years he evinced a love of knowledge. He went to the root of all that he felt worth learning; the more difficult the research, the more fascinating.

He was tutored at home by his mother, until he entered his teens. She recognized and appreciated his talents, and furthered their development. He loved nature, especially in the animal and vegetable kingdoms. I remember when a child seeing him pore over his volumes of natural history and filling a book with drawings of animals and of birds, sketches from nature, and copied from these histories.

He had such a love for drawing and painting, that at one period he thought seriously of making this his life work. He possessed great versatility of thought and aptness of learning in almost every branch.

He inherited a taste for languages from his father, who was a graduate of Williams College, Mass.; and afterwards of Yale College in 1813.

My brother, Dr. William C. Avery, graduated at Burlington College, N. J. in 1851 or '52. His college life was one of great happiness; wrapped in the pursuit of learning he won the esteem of the professors and the friendship of the students, many of whom were to be noted men in the world. He seemed utterly free from self conceit, so that none manifested envy towards him. In regard to literary investigations he was thoroughly self-reliant and self-sufficient, yet showing nothing of arrogance towards others.

After graduating at Burlington College, he taught school for several years. He then studied medicine at

the University of Pennsylvania and completed his course in Paris.

While in Paris he studied French, sparing no pains in becoming proficient in that language. He frequently avoided meeting his friends from America, not wishing to speak English while striving for fluency in French.

Just so it was while he was in Italy, Germany and Spain, his application was such that he became proficient in these languages also. While in Europe he traveled in Germany and Switzerland on foot, there studying nature.

After his return home he decided to settle for life in Marshall, Texas, and there to practice medicine. After a few years, he returned to his old home, "Contentment," near Greensboro, Ala., to visit his mother. Feeling that it was best to be near her, he did not return to Texas, but settled in Selma, Ala., in the early spring of 1861.

His office had scarcely been opened, when the signal of war sounded. He was filled with enthusiasm. He gave up everything and enlisted as a private in Col. N. H. R. Dawson's regiment.

His lot was never to be in a battle, for like many a fellow soldier, he was taken with measles soon after reaching Virginia. He knew nothing of the glories of a soldier's life, only sickness and weariness in the soldier's camp.

Recovering from the measles he came with his division to Dumfries on Ocoquon Creek, Virginia, not far from Washington City. There, from fatigue and lack of suitable care and nourishment in his broken down condition, he was taken with typhoid fever. That he did not die seemed a miracle; but he was saved for other work. Through this illness he was incapacitated for the duties of a soldier. His furlough and discharge from the army were granted and he returned to Greensboro, Ala., where he taught school for some time and then resumed the practice of medicine. He did not care for town life, but always made his home in the country.

Living in close touch with nature he had the opportunity of gratifying his love of natural history. He studied ornithology and related subjects for the mere love of them, but he became soon an ornithologist recognized and endorsed by the first in our land.

By correspondence he became well known to ornithologists, and among them claimed as his friends, Messrs. J. A. Allen and Frank Chapman, curators in the Museum of Natural History, Central Park, N. Y.; and Prof. Coues, Messrs. Bendire, Merriam, and Robert Ridgway of the Smithsonian Institution in Washington City.

He had a great desire to make a collection of the birds of Alabama. Like many a gifted student, he had no money of his own, nor the aid of influential wealthy friends to advance him in his work. This did not deter him but added zeal and determination to his desire. He was very accurate. Time and labor were factors to prove or establish a fact.

He anticipated the necessity of the "bird law" which has recently been passed. In 1882 he wrote a long article on "Causes Leading to the Lessening and Destruction of our Game." This article is given below in the Systematic List.

Not long after the English sparrow was introduced into Central Park, New York, I spent the summer in Orange, N. J. The little birds increased so rapidly that Central Park could not hold them, and myriads flocked to the Jersey town. Now it was hoped that gardens and orchards would be freed from insects. Everybody rejoiced. I was fascinated with them, and made arrangements to take some of them home to my brother but I was disappointed. After getting home I told him of my plan, saying, "Brother, I hoped to bring you a lovely present, a gift that would give you more pleasure than anything else, but I did not succeed." "What was it?," he asked. "Oh," I replied, "a cage full of lovely little English sparrows. There were thousands of them in Orange, N. J., and everybody was wild about them." "English sparrows," he exclaimed. "Thank God, you did not succeed. Don't you know that they will prove

an awful pest. Those who introduced them thought the English sparrow was insectivorous, but instead it is granivorous; and I trust we will not have them here." After all they have come to stay.

To him no pleasure was equal to going off with gun, game bag and note book and spending the whole day, alone in the most unfrequented woods to watch the habits of birds.

Dr. Avery wrote very little for publication. His most important articles are in the American Field; Vols. XXXIV and XXXV, published in 1890 and '91. His correspondence with ornithologists, mammalogists and taxidermists was quite extensive and always instructive.

He made a collection of 900 birds, preparing them for scientific use, according to Audubon's plan. This collection was purchased by the Geological Survey of Alabama through Eugene A. Smith, State Geologist, and is now in the Alabama Museum of Natural History, University of Alabama.

In January, 1894, Dr. Avery seemed less capable of enduring great fatigue. We feared heart trouble. And thus it was for on March 11, 1894, God called him suddenly to his eternal rest.

"He who dies believing,
Dies safely through His love."

On his father's side, Dr. Avery was a lineal descendent of Dr. William Avery who came to America from Berkshire, England, in 1650; of Robert and Thomas Cushman, who came to America in the Mayflower in 1620; and of Isaac Allerton, likewise a Mayflower passenger.

On his mother's side he was closely related to Robert Treat Paine, one of the signers of the Declaration of Independence.

THE ORNITHOLOGICAL NOTES OF DR. WILLIAM CUSHMAN AVERY

INCLUDING A CATALOGUE OF HIS ALABAMA COLLECTION.

Compiled and Edited by Ernest G. Holt.

INTRODUCTION.

IN THE Museum of the Geological Survey of Alabama, at University, is a small but well preserved collection of birds brought together by the late Dr. William Cushman Avery of Greensboro, Ala. Most of the specimens were collected and preserved by Dr. Avery's own hands, although there are many secured by exchange with well known ornithologists, and a few that were purchased. The collection as a whole is fairly representative, except for the water birds, but is of especial interest because the greater part of the specimens were collected in the vicinity of Greensboro, and at other points in Alabama—a State none too well known ornithologically.

Since the death of Dr. Avery in 1894, many sub-species have been described and sweeping changes have been made in nomenclature, rendering a revision of the collection desirable. The privilege of this work was given the writer by Dr. Eugene A. Smith, State Geologist, and in January, 1914, a complete check of the collection was made with the assistance of Mr. Lewis S. Golson, of Prattville, Ala. All records were placed at our disposal, and though these consisted only of five combination catalogues and journals and a few loose pages, many interesting facts regarding the bird-life of the region and the early ornithological struggles of Doctor Avery were gleaned from them.

It was at first proopsed by Dr. Smith to publish a catalogue of the revised collection, but because Dr. Avery's published notes are scattered through journals long since out of print, or otherwise unavailable, and because the unpublished material contained in his note-book seems of considerable value, it was decided to bring all together in a bulletin in the form of an annotated catalogue. The following list of 216 species and subspecies is the result. Alabama specimens only are included in this, though the collection contains many western and northern birds, and others taken beyond the boundaries of

the State. Dr. Avery did not collect personally outside his native state and almost all the specimens listed herein were taken by himself. It has been the writer's aim to make of this bulletin at once a complete resume of Doctor Avery's ornithological labors, and to bring together any interesting facts connected with the acquirement of his store of bird-lore.

Because of the exigencies of the writer's service with the U. S. Biological Survey, the work of searching through the Doctor's old records and compiling his published papers had to be done at odd moments between field trips. The war caused a further delay and the actual writing of the manuscript was accomplished in a military camp after the signing of the armistice. Thus several years have elapsed since the collection was worked over but the results have not been affected by the delay in publication.

It is worthy of note that Dr. Avery did not take a scientific interest in birds until comparatively late in life; this interest continued, however, until almost the hour of his death—7:30 o'clock on Sunday morning, March 11, 1894. His last specimen catalogued was a mockingbird taken on March 5th, 1894. The earliest note found is dated June 21, 1875, the fortieth anniversary of his birth, and is written in French on a page cut from an old journel (see under *Piranga r. rubra,* No. 151). A catalogue of fifty-five numbers and an "Oological Register" of seven numbers, running from May 23, 1876, to August 23, 1881, is contained on a few other pages from the same old account book, but few of these specimens are now in the collection. His really serious work was begun apparently in 1886, when he started a catalogue on July 6th. This latter catalogue is an orderly affair entered in five books through which are dispersed fragmentary journal records, notes on bird habits, song, nesting, and other items of interest.

Though Dr. Avery's published writings are not in themselves of great importance, his ornithological work bore abundant fruit through others. He contributed quite a number of stomachs of raptorial birds to the U. S. Bio-

logical Survey (then the Division of Ornithology and Mammalology), the analyses of which are included in Dr. A. K. Fisher's classic work on "The Hawks and Owls of the United States in Their Relation to Agriculture." His correspondence with Dr. Fisher was extensive and it is very interesting to learn from Dr. Fisher that he himself, by mail, through the medium of the English sparrow, taught Dr. Avery to make bird skins. Sparrow skins were prepared in such a way as to show the different operations necessary to produce a good museum skin and forwarded to Dr. Avery who thus was enabled to copy them in preparing other birds. Dr. Fisher also identified many of the more obscure species for Dr. Avery.

Dr. Avery also corresponded actively with the officials of the U. S. National Museum and the American Museum of Natural History, notably: Dr. Elliott Coues, Major Charles E. Bendire, Robert Ridgway, Dr. J. A. Allen, and Dr. Frank M. Chapman. He contributed many specimens to both museums, including birds, eggs, nests, and notes which were sent to Maj. Bendire. Among the old Avery papers is quite a bundle of the diploma-like acknowledgments of these specimens by the Smithsonian Institute, all signed by G. Brown Goode, Assistant Secretary. His sets of *Peucaea aestivalis bachmani* were of considerable importance; and Davie's quotation in "Nests and Eggs of North American Birds" of Bendire's description of "5 nests and several full sets" form the greater part of the information regarding the nesting of Bachman's sparrow published in that work. A series of specimens of *Quiscalus quiscula* was collected to aid Mr. Ridgway in working out the relationships of the different subspecies. Besides the aforementioned scientists, Dr. Avery corresponded more or less regularly with the following: Dr. Harrison Allen, University of Pennsylvania; Frank B. Armstrong, Brownsville, Texas; Prof. Spencer F. Baird, Smithsonian Institution; William Brewster, Cambridge, Mass.; C. S. Brimley, Raleigh, N. C. (Brimley visited Avery at Greensboro in September, 1890); George G. Cantwell, Lake Mills, Wisconsin; F. H. Carpenter, Rehoboth, Mass.; William Dutcher, New York

City; H. W. Flint, New Haven, Conn.; Flood Brothers, Hudson, Mass.; Thomas H. Jackson, West Chester, Pa.; Thomas McIlwraith, Hamilton, Ontario; Dr. C. Hart Merriam, Washington, D. C.; J. T. Park, Warner, Tenn.; Harry G. Parker, Chester, Pa.; Charles J. Pennock, Kennett Square, Pa.; G. H. Ragsdale, Gainesville, Tex.; W. G. Smith, Colorado; G. E. Stilwell, Kansas City, Mo.; Frank B. Webster, Boston, Mass. There are specimens in the collection taken by Dr. Edgar A. Mearns, W. E. D. Scott, L. M. Loomis, and John Rowley, but the writer was unable to ascertain whether Dr. Avery corresponded directly with these gentlemen or received the specimens in exchange through some of his museum correspondents. Many of the letters from his correspondents fortunately are preserved in the files of the State Department of Archives and History, at Montgomery, and these are very interesting. For instance there is one from Robert Ridgway thanking Dr. Avery for correcting the diagnosis of *Dendroica vigorsi* as published in the former's "Manual of North American Birds," 1887, and Dr. J. A. Allen tells how to make a fat scraper and gives a few hints on poisoning the tails of mammal skins.

That Dr. Avery's interest in Zoology was not confined to birds is evidenced by a catalogue of fifty-three mammals taken Dec. 16, 1890, to Feb. 2, 1894. The collection included mice, rats, moles, skunks, chipmunks, musk rats, minks, flying squirrels, and others, the most of the specimens were little spotted skunks. Apparently few of his specimens were retained for his own collection, the majority being sent to Dr. A. K. Fisher, Dr. C. Hart Merriam, and the Smithsonian Institution. Snakes also were collected and sent to Dr. Leonhard Stejneger of the U. S. National Museum, and there was some correspondence with Drs. L. O. Howard and C. L. Marlatt, of the U. S. Bureau of Entomology, relating to insect specimens sent to them by Dr. Avery for identification. Dr. Avery was also something of an amateur botanist.

Doctor Avery was ever the sportsman. Besides being an enthusiastic gunner he was a lover of dogs and was widely known as an excellent trainer of these animals.

An extensive correspondence was carried on with I. Yearsley, Jr., of Coatesville, Pa., for whom he trained many bird-dogs. He also raised and sold dogs registered with the American Kennel Club of New York City. He was also interested in game fowls as shown by the following note from his sister, Miss Mary E. Avery: "You will notice that there are quite a number of hawks in the collection. I am sure that my brother felt a peculiar pleasure in stuffing them rather than they should stuff themselves with his beautiful game fowls." Like all true sportsmen the Doctor was keenly interested in guns, and the two works following occupied a place among his bird books: "The Gun and Its Development," 1884, by W. W. Greener, and "The Dead Shot; or Sportsman's Complete Guide: Being a Treatise on the Use of the Gun," 1867, by "Marksman." Another book, much used and bound in cloth, probably by Dr. Avery himself, is "The Wild-Fowler," 1864, by H. C. Folkard. In a letter from Amory R. Starr of Marshall, Texas, is the interesting statement that Dr. Avery was the "first to introduce the use of short guns into this section; by short guns meaning 30 and 32 inch barrels." At that time (August 28, 1889) however, one of Mr. Starr's friends was still addicted to the use of a 48-inch muzzle-loader! Doctor Avery owned several guns, of course, because he hunted deer as well as quail. For his ornithological collecting he used a .44 caliber and No. 12 shot.

Dr. Avery was an authority on Latin and Greek and was not unacquainted with French, Spanish and German. Much of his correspondence with Dr. Coues and Mr. Ridgway related to the etymology of ornithological names, and Mr. Ridgway in several letters took occasion to thank Dr. Avery for his criticisms of the nomenclature used in the "Manual of North American Birds," 1887. A considerable portion of Dr. Avery's correspondence with Dr. Merriam was devoted to questions of nomenclature, particularly etymology, and to some of Dr. Avery's criticisms of the nomenclature adopted by the American Ornithologists' Union Dr. Stejneger replied at length through Dr. Merriam. Dr. Avery was a stickler for the

classic Latin and Greek and of course his ideas did not conform to the A. O. U. rules on original spelling. Miss Mary E. Avery in a letter to Dr. T. M. Owen writes that "It would be difficult to say whether he loved the study of languages or of nature best."

Dr. Avery became an Associate Member of the American Ornithologists' Union in 1887, and his name was listed in "The International Scientists' Directory," published by S. E. Cassino, Boston, 1888.

Though Dr. Avery's serious interest in ornithology did not awake until late in life, he then surrounded himself with the best books that could be had at that time on the subject. In his library were found among others, the following: Coues' "Key to North American Birds," 1872; Ridgway's "Manual of North American Birds," 1887, and "Nomenclature of Colors for Naturalists," 1886; Davie's "Nests and Eggs of North American Birds," 1889; A. O. U. "Code of Nomenclature and Check-List of North American Birds," 1886; Maynard's "Naturalist's Guide," 1887; and Hornaday's "Taxidermy and Zoological Collecting," 1891.

Dr. Avery was much concerned over the increasing scarcity of birds and scattered through his journals are many references to the subject. The following are of interest: "Sept. 5th, 1889. Saw on the edge of a piece of woods many warblers, gnatcatchers, and cuckoos feeding evidently upon the army worms on the cotton in the adjacent field. Shot a blue yellow-back warbler; too badly shot to preserve; this individual with several others of the same species, and numerous blue-gray gnatcatchers were feeding on army worms.

"I have often seen the fields around woods completely protected against worms by the birds; but that was fifteen or twenty years ago. The birds have decreased so since that time that they seem to make little impression on the army of worms even around forests."

"Jan. 22, 1892. Birds have been scarcer this winter than I have ever known them before; a few myrtle warblers, and sparrows, with now and then a robin, or a small bunch of cedar waxwings are nearly the sum total of our

birds. Breech-loaders in the hands of free negroes are fast exterminating our small birds, as they have already destroyed our squirrels and hares; our game little partridges (*Colinus*) also are fast disappearing."

"Sept. 27, 1893. The day was bright and clear and many birds were seen, but a negro began to shoot and continued his fusillade at the little birds from eight o'clock in the morning till ten. It was gall and wormwood to me to hear the report of his gun every four or five minutes. How many beautiful birds this savage must have killed!"

In this connection see notes under *Colinus v. virginianus*, No. 56 and the fifth paragraph under *Meleagris g. silvestris*, No. 57.

In the following pages each species of bird noted by Dr. Avery is listed in the systematic position adopted in the 1910 edition of the "A. O. U. Check-list of North American Birds." The nomenclature used here is that of the same work, except as noted in specific instances. Under each species or subspecies are brought together all the notes on that form that could be found, published or unpublished, regardless of the source from whence derived. All of his published ornithological writings are here republished but not in their original form, the notes being assembled under the species to which they refer. After each quotation from a published paper is given a date, often followed by a letter, in parentheses; this is the date of publication and refers to the bibliography at the end of the bulletin where complete titles and references to original publication are given. Original (unpublished) notes are enclosed within quotation marks but are not followed by a bibliographical reference. Where specimens of any given bird exist in the collection, these are listed as the last items under the particular species or subspecies concerned.

All notes refer to Hale county, Alabama, unless otherwise specified.

The writer acknowledges with gratitude the assistance received from Mr. Alexander Wetmore, Mr. Arthur H. Howell, and the late Prof. Wells W. Cooke of the U. S. Bureau of Biological Survey. Many of the specimens in

the Avery collection were identified by Dr. H. C. Oberholser of the same bureau. Thanks are also due Dr. Thomas M. Owen, director of the State Department of Archives and History, for granting access to the Avery books and correspondence on file in his department. But the writer is especially indebted to Mr. Lewis S. Golson of Prattville, Alabama, for his assistance in working over the collection, and to Dr. Eugene A. Smith, State Geologist, for making possible the entire undertaking.

ERNEST G. HOLT.

Barachias, Ala.
May 22, 1919.

SYSTEMATIC LIST.

(For explanations see closing paragraphs of Introduction.)

1. PODILYMBUS PODICEPS (Linnæus).
PIED-BILLED GREBE.
"Didapper."

Speaking of this bird in Hale County, Dr. Avery stated that it was "Not uncommon during spring migration" (1890d) and records taking a specimen on March 15th (1884).

2. GAVIA IMMER (Brunnich).
LOON.

"A specimen has been taken on a pond eight miles west of Greensboro, at Umbria." (1890d).

3. LARUS ATRICCILLA (Linnæus).
LAUGHING GULL.

There were no notes on this species found among the Avery papers, though the following specimen is in the collection:

No. 495. Dauphin Island. Sept. 20, 1892. W. C. Avery.

4. STERNA MAXIMA (Boddært).
ROYAL TERN.

Dr. Avery records taking the royal tern "on the Gulf," presumably near Dauphin Island on Sept. 19, 1892.

5. STERNA ANTILLARUM (Lesson).
LEAST TERN.

"One specimen shot on Cocke's Mill Pond, five miles west of Greensboro." (1890d). This specimen is not in the collection and the date of capture could not be found in the original notes.

6. HYDROCHELIDON NIGRA SURINAMENSIS (Gmelin).
BLACK TERN.

"Seen rarely during the fall migration. I have in my collection a specimen shot by William Hall, of Greensboro,

in the latter part of July, 1888." (1890d). The stomachs of the two specimens in the collection were "packed with cotton-boll flies."

No. 1064. Male. Cocke's Pond near Greensboro. Sept. 11, 1893. W. C. Avery.
No. 1065. Male. Cocke's Pond near Greensboro. Sept. 11, 1893. W. C. Avery.

7. RYNCHOPS NIGRA (Linnæus).
BLACK SKIMMER.
"Shearwater."

"Black skimmer, common Gulf Coast of Baldwin (County), Sept. 21, 1892. Several specimens were taken on Dauphin Island, Sept. 21, 1892" (Original notes). An odd head, bearing no label, seems to be the only trace of these specimens in the collection.

8. ANHINGA ANHINGA (Linnæus).
WATER TURKEY.

"Found rarely; breeds; resident" (1890d).
One specimen without label.

9. PHALACROCORAX AURITUS (Lesson).
CORMORANT.
"Nigger Goose."

In 1892 Dr. Avery spent the time between Sept. 16th and Oct. 2nd in Baldwin County and along the Gulf Coast to Dauphin Island. He records: "Cormorants were seen, but no specimens were taken."

10. PELECANUS ERYTHRORHYNCHOS (Gmelin).
WHITE PELICAN.

See note under succeeding species.

11. PELECANUS OCCIDENTALIS (Linnæus).
BROWN PELICAN.

The following note appeared under "Natural History" in the "American Field" for July 1, 1893:

"Mr. J. S. Christy in the American Field of June 17 describes the American white pelican *(Pelecanus erythrorhynchos)* and he wishes to know: 'Whence it came or where its native home is.' The American white pelican

is generally common west of the Mississippi river, and breeds from Utah northward. It is rare, however, in the Atlantic and Gulf States. A white pelican was taken several years ago near Livingston, Alabama. Captain J. W. A. Wright, of Livingston, mounted the specimen. I have never seen the white pelican; but on Sept. 20, 1892, I took two specimens of the brown pelican *(Pelecanus fucus)* near Fort Morgan, on the Gulf of Mexico. I found the brown pelican common all along the coast, from Perdido Bay to Dauphin Island." (1893a).

12. LOPHODYTES CUCULLATUS (Linnæus).
HOODED MERGANSER.
"Summer Duck."

"Not common; winter resident" (1890d). This bird should be found breeding in Hale county in favorable places. Broods of young have been observed in Autauga county.

13. ANAS PLATYRHYNCHOS (Linnæus).
MALLARD.
"Greenhead."

"Common; winter resident." (1890d).

14. ANAS RUBRIPES (Brewster).
BLACK DUCK.
"Black Mallard."

"Rare; winter resident." (1890d).

15. MARECA AMERICANA (Gmelin).
BALDPATE.

Writing of the pintail in a letter to the American Field, Dr. Avery stated "This duck appears here (Greensboro) about the first of March, with the blue-wing teal, the bald pate and the blue-wing shoveller." (1884). Six years later he wrote, "Seen occasionally fall and spring." (1890d).

16. NETTION CAROLINENSE (Gmelin).
GREEN-WINGED TEAL.

"Once abundant, now rarely seen. Winter resident." (1890d). This statement must be taken as comparative,

for the green-winged teal is still one of the common ducks in Alabama.

17. QUERQUEDULA DISCORS (Linnæus).
BLUE-WINGED TEAL.

The first mention made of this species by Dr. Avery was incidental, in writing of the pintail, and the quotation will be found under that species. He states in this article that the blue-winged teal appears at Greensboro about March 1st, but in his original notes for 1886 there is a record of the bird on Sept. 10th, and in 1891 this note appears under date of Sept. 14th: "A flock of blue-winged teal were reported at Cocke's Pond, of which Mr. Cocke bagged two." "Once common, now seldom seen. Winter resident." (1890d).

No. 1082. Female. Greensboro. Oct. 9, 1893. W. C. Avery.

18. SPATULA CLYPEATA (Linnæus).
SHOVELLER.

For first mention of this species see note under *Dafila acuta*. "Seen in the spring, never in large numbers, but in bunches of six to eight at the highest." (1890d).

19. DAFILA ACUTA (Linnæus).
PINTAIL.

"March 2nd I saw and obtained a specimen of *Dafila acuta* (Pintail.) Have heard of others being shot. This duck appears here about the first of March, with the blue-wing teal, the bald pate and the blue-wing shoveller." (1884. "Once abundant during spring and autumn migrations; but, like all ducks, growing yearly scarcer in this country." (1890d).

20. AIX SPONSA (Linnæus).
WOOD DUCK.
"Summer Duck."

"Once abundant, now not at all common. Twenty-five years ago, in September, I saw one morning at least three hundred of these ducks come at dawn, to feed in a pond, at Millwood, on the Warrior River, ten miles

west of Greensboro. Now for a whole year not half of that number could be found in that locality." (1890d).

No. 1006. Male. Warrior River, Greensboro. Dec. 2, 1892. W. C. Avery.
No. 1007. Female. Warrior River, Greensboro. Dec. 3, 1892. W. C. Avery.
No. 1008. Male. Warrior River, Greensboro. Dec. 3, 1892. W. C. Avery.

21. MARILA AMERICANA (Eyton).
REDHEAD.

"About ten years ago common in the Cypress Slough, near Millwood, on the Warrior River. Has not been seen for eight or ten years." (1890d).

22. MARILA MARILA (Linnæus).
SCAUP DUCK.

"Common on the Warrior River. Winter resident." (1890d).

23. MARILA AFFINIS (Eyton).
LESSER SCAUP DUCK.

"Has not been seen for ten years; once common during migrations." (1890d).

No. 908 (805) Female. Warrier River. Greensboro. Nov. 7, 1890. Cy Jones.

24. BRANTA CANADENSIS CANADENSIS (Linnæus).
CANADA GOOSE.

"Rare. Winter resident." (1890d).

25. MYCTERIA AMERICANA (Linnæus).
WOOD IBIS.

Dr. Avery's original notes show that he took one of these birds at Cocke's Pond, five miles west of Greensboro, July 26, 1891, though unfortunately the specimen is not now in the collection. He writes: "This bird has been seen several times but never collected till this specimen and hence never with certainty identified. When it was seen some years ago at Cocke's Pond it was then supposed to be the wood stork or ibis." His supposition seems to have been correct.

26. BOTAURUS LENTIGINOSUS (Montagu).
BITTERN.

"Not common. Spring migrant." (1890d).

No. 818. Male. 5 mi. W. of Uniontown. Mar. 28, 1891. W. C. Avery.

27. ARDEA HERODIAS (Linnæus).
GREAT BLUE HERON.
"Big Blue Crane."

"Common. Resident. Breeds." (1890d). Under date of Sept. 21, 1892, Dr. Avery wrote in his note book: "Great blue heron seen frequently on Perdido Bay and along the Gulf Coast." These birds were probably subspecies *wardi*. A specimen taken Nov. 26, 1913, by Pratt Thomas on the Black Warrior River, near University, Ala., is referable to *herodias*.

28. HERODIAS EGRETTA (Gmelin).
EGRET.
"White Crane."

In 1884 Dr. Avery published the following record of this species: "There (Cocke's Pond, five miles west of Greensboro) I shot last spring a beautiful specimen of the great white egret, *Ardea egretta*." (1884). Six years later he writes: "Rare. I have a specimen in my collection which was shot at Cocke's Mill Pond, five miles west of Greensboro; I have seen two others. My specimen is labeled August 14. The other two were seen in the spring." (1890d).

No. 183. Female. Greensboro. Aug. 14, 1889. W. C. Avery.

29. EGRETTA CANDIDISSIMA CANDIDISSIMA (Gmelin).
SNOWY EGRET.

A specimen of this species was taken in Greene County, July 1, 1889, and mounted by Dr. Avery for John Cocke, Jr., of Cockeville.

30. FLORIDA CÆRULEA (Linnæus).
LITTLE BLUE HERON.

"Common. Summer resident." (1890d).

No. 186. Male. Millwood, near Greensboro. Aug. 16, 1889. W. C. Avery.

31. BUTORIDES VIRESCENS VIRESCENS (Linnæus).
GREEN HERON.
"Fly-Up-The-Creek."

"The first recorded specimen of this heron was shot June 9, 1888, while "flying down the Walton Bottom" near Greensboro. Its stomach was filled with crawfish. Common. Summer resident. Breeds." (1890d).

No. 171. Male, hornot. Greensboro. July 12, 1889. W. C. Avery.
No. 869. Sex (?). Greensboro. June 24, 1891. W. C. Avery. Odd specimen with no label.

32. NYCTICORAX NYCTICORAX NÆVIUS (Boddært).
BLACK-CROWNED NIGHT HERON.

In his original notes, Dr. Avery records this bird near Greensboro, Sept. 6, 1886, but for some reason omitted the record from his "Birds Observed in Alabama," published in 1890.

33. NYCTANASSA VIOLACEA (Linnæus).
YELLOW-CROWNED NIGHT HERON.

July 1, 1879, recording the capture of one of these herons, Dr. Avery wrote: "This bird lit in a cedar (in the back yard) where the fowls had gone to roost. It was killed after sunset." Eleven years later he published this note: "Not common. A specimen in my collection is labeled Aug. 12." (1890d).

No. 185. Female. Greensboro. Aug. 12, 1889. W. C. Avery.

34. GRUS AMERICANA (Linnæus).
WHOOPING CRANE.

"Rare. Seen many years ago in the Cypress Slough, Millwood." (1890d).

35. RALLUS ELEGANS (Audubon).
KING RAIL.

Concerning this bird, Dr. Avery in 1888 published the following:

"On the 24th of March I met three small boys who were returning from the field with dogs and guns. Besides a half dozen hares which one of them carried on a

string over his shoulder, was a king rail (*R. elegans*) tied by the leg and in the hands of one of the boys.

"It seems that the rail had been pointed by their dog, flushed and shot at. She returned immediately, however, to the spot where she had been flushed first, and allowed herself to be captured by the boys. I asked permission of the owner to examine the bird, and observing a protuberance near the vent, I pressed it, and received in my hand a mature egg. This egg measures 1.54 by 1.22. The ground color is dull white, blotched and spotted with rusty brown, also specks of the same color and indistinct spots of lilac. The brown spots are largest and irregularly scattered over the surface. They vary in size from fifteen hundredths to the one hundredth of an inch in diameter. I returned to the marsh with one of the boys, who not being able to locate the tussock of bulrush where they had captured the rail, our search for the nest was fruitless." (1888).

Two years later he wrote: "Not common. Resident. Breeds." (1890d).

No. 327. Male. Greensboro. Dec. 23, 1889. W. C. Avery.
No. 853. Male. Greensboro. May 23, 1891. W. C. Avery.

36. PORZANA CAROLINA (Linnæus).
SORA.

Recorded by the Doctor at Greensboro, Oct. 10, 1888. Another entry in his original note books read: "A single individual of the sora was seen and taken on Dauphin Island, Sept. 21, 1892."

"Rare. Occurs during autumn and spring migrations." (1890d).

No. 1028. Male. Greensboro. Mar. 11, 1893. W. C. Avery.
No. 1029. Female. Greensboro. Mar. 11, 1893. W. C. Avery.

37. COTURNICOPS NOVEBORACENSIS (Gmelin).
YELLOW RAIL.

In consulting the entry in the Doctor's original catalogue of the specimen cited below, this note was found which serves to show his view of a certain phase of nomenclature: "My first record of the yellow crake. In looking up the name of this bird I find that the A. O.

U. have adopted the appellation rail instead of crake used by Dr. Coues. Now it is very desirable that we should have generic names as precise as possible. Why not translate *Porzana (Coturnicops* was then included under *Porzana*) as crake and *Rallus* rail?"

No. 964. Male. 10 mi. S. of Greensboro. Dec. 19, 1891. W. C. Avery.

38. FULICA AMERICANA (Gmelin). Coot.

In 1886 Dr. Avery published an article in the "Ornithologist and Oologist" entitled, "Migration of the Coot," and four years later used much of the same material in his list which appeared in the "American Field." However, it is considered worth while to republish here both notes in full.

"A fact relative to the migration of the coot (*Fulica americana*), known here by the French name, Poule-d' eau, may, perhaps, be worth recording. About the middle of April, 1885, as I was going out of the house at sunrise, my attention was attracted to a bird sitting within a few feet of the porch. It proved to be a coot. Instead of trying to escape, as any other bird would have done, when I extended my hand to catch it, the poule-de'eau showed fight. I confined it in a chicken-coop in the yard, and supplied it with some corn-bread and water. If it ever ate or drank while in my possession, I was not aware of the fact. It took, to my knowledge, neither food nor water. It seemed to spend every minute of the day and night in perpetual motion. Its efforts were not in vain.

" 'Omnia vincit improbus labor,' was, doubtless, the motto of my prisoner. By thrusting the head and neck through every opening within reach, the restless bird at last forced off a slat and recovered its freedom. On the third day after it had been placed in 'durance vile,' I saw it standing on top of its prison pluming itself. I advanced towards it, expecting to capture it again. Imagine my surprise when it rose on strong pinions, flying high and going in a northerly direction, as far as I could see it. This was not the first time that I had seen in

the spring this, to me, apparently silly bird offering battle to its captor. I had believed that 'coot' and fool were justly synonymous.

"The coot has been slandered; it does not fly because it *cannot* fly. Not because it wants the sense of danger, but because it has not the power to escape, does it allow itself to be taken, when it drops exhausted, on its long migratory flight, and rests till its tired wings have recovered strength to bear it onward." (1886a).

"Spring and autumn migrant. Among the various names given to this bird is that of 'fool hen.' 'Coot' is also a synonym of stupidity. I believe this to be a slander on this bird. Some years ago, as I stepped out of doors early one morning, I found a coot seated under the edge of the steps. It made no effort to escape, as it was exhausted, and had fallen there to rest during the night. I kept it confined in a coop for several days; most of the time was spent by it, night and day, in the endeavor to escape; it finally pushed off a slat from the coop, and I found it seated there pluming its feathers. On seeing me approach to recapture it, it took wings and flew northward, and went in that direction as far as the eye could reach. On October 29 last a specimen of this bird was brought to me; it is now in my collection. It lay in a fence corner where it had fallen and was resting to resume its migration southward. It did not try to escape, but simply pecked at the hand of its captor. It could not fly, and did not make the attempt. Instead of being a 'fool,' it acted wisely, as escape was impossible." (1890d).

No. 800. Female. Greensboro. Oct. 29, 1890. W. C. Avery.

39. PHILOCHELA MINOR (Gmelin).
WOODCOCK.

"The woodcock is not a common bird in this part of Alabama (Hale County) and for that very reason it is more prized by the sportsman here than any other species of game, not even the Bob White excepted.

"Very few woodcocks are found in the black lands; but in the willow thickets, and swamps of the northern

part of Hale County, with a dog trained to hunt them, the shooter might bag half a dozen of these interesting birds in a day. There are many more of them always than one would suppose, as they escape notice by their retired habits. The almost impenetrable briar patches and sloughs, where they lie concealed till twilight, save many of them from the bird bag. At that hour of the day the whistle of their wings may be heard as they pass swiftly by to their feeding grounds in the open fields. They are mute till the nesting season, which begins here early in February. Then they are quite a noisy bird. The male makes his whereabouts known at that time by ascending on sounding pinions, just before night, and, suspended several hundred feet above some open land, cotton or corn field, now bare, he plays fantastic tunes before high Heaven. The observer might mistake these tunes, which the woodcock plays with his wings, for songs; but he cannot produce a musical sound except with his wings, which are the Aeolian-harp, and the primaries or pinions are the strings of that harp, whose vibrations are very similar to the sounds produced by running the fingers over the strings of a guitar.

"When this aerial performance, which lasts for several minutes, is ended, he falls headlong to the ground, and so rapidly that he is generally secure from any untimely shot that might be intended for him.

"Now begins his call to his dusky partner. There is no music in that 'spake' followed by a dissyllable so low and whispered that it can be heard only at a few feet distant, 'gooduck!' All is silent; then comes another 'spake! gooduck!' This is certainly not musical; but it answers the purpose of a song and serves to attract the female.

"Woodcocks were 'soaring' and 'spaking' here on the sixth of last February—'spaking,' as the Irishman would say, to their fair companions. Is there a shooter—I will not say a sportsman—who kills woodcocks here in the South in February? If there is, he is not a sportsman, but an assassin." (1890a).

In Dr. Avery's original note books, under date of Feb. 23, 1893, is the following entry:

"Took a nest of woodcock on the edge of a swamp next to Hopewell Branch. Set of 4; incubation slight. Nest was about 6 inches above the level of the marsh. Material: leaves and pine straw. The old bird was pointed on the nest by my setter 'Jeff Bo,' and I flushed and fortunately missed it when I fired, not being aware that she was sitting—reflection, woodcock should not be shot in Alabama after the middle of January."

No. 291. Female. Greensboro. Dec. 3, 1889. Gaillard Harvey.

40. GALLINAGO DELICATA (Ord).
WILSON'S SNIPE.
"Snipe."

The earliest record found of this species is a note dated Jan. 17, 1878, giving measurements of an adult male taken at Greensboro. It reads further, "I have shot snipe as early as the middle of September; they generally appear late in the fall and are abundant till April."

"*Gallinago wilsonii* has been abundant since the latter part of February. Wilson's snipe is always on the move here; hundreds appear at times and after remaining a few days suddenly disappear. A few, however, spend the winter here." (1884).

"Spring and autumn migrant. Once abundant; now not common." (1890d).

The following appears among the Doctor's original notes for 1891: "September 12: Wilson's snipe were seen at Cocke's Pond September 14; four or five Wilson's snipe were seen at Cocke's Pond and one was bagged by Mr. Cocke's son Webb. September 16; collected at Cocke's Pond two yellow shanks (*Totanus flavipes*); also Wilson's snipe (*Gallinago delicata*)."

On the label of the specimen listed below was found the interesting bit of information that the "stomach contained two leeches."

No. 987. Female. Greensboro. Mar. 19, 1892. W. C. Avery.

41. PISOBIA MACULATA (Vieillot).
PECTORAL SANDPIPER.

"Not common. Spring migrant." (1890d).

"Several pectoral sandpipers were observed on Dauphin Island, Sept. 21, 1892." (Original notes).

No. 996. Male. Dauphin Id. Sept. 21, 1892. W. C. Avery.
No. 997. Male (?). Dauphin Id. Sept. 21, 1892. W C. Avery.
No. 998. Female. Dauphin Id. Sept. 21, 1892. W. C. Avery.
No. 1030. Male. Greensboro. Mar. 25, 1893. W. C. Avery.
No. 1031. Male. Greensboro. Mar. 25, 1893. W. C. Avery.
No. 1045. Female. Greensboro. Apr. 15, 1893. W. C Avery

42. PISOBIA FUSICOLLIS (Vieillot).
WHITE-RUMPED SANDPIPER.

"Not common. Spring migrant. Two specimens taken May 26, 1888." (1890d).

No. 858. Female. Cocke's Pond, Greensboro. May 30, 1891. W. C. Avery.
No. 860. Female. Cocke's Pond, Greensboro, May 30, 1891. W. C. Avery.
No. 861. Male. Cocke's Pond, Greensboro, May 30, 1891. W. C. Avery.
No. 862a. Female. Cocke's Pond, Greensboro. May 30, 1891. W. C. Avery.

43. PISOBIA MINUTILLA (Vieillot).
LEAST SANDPIPER.
"Peep."

"Several seen on the Island (Dauphin) Sept. 21, 1892." (Original notes).

No. 837a. Male. Greensboro, May 9, 1891. W. C. Avery.
No. 840. Female. Greensboro, May 9, 1891. W. C. Avery.
No. 849. Female. Greensboro, May 16, 1891. W. C. Avery.
No. 851 (?). Male. Greensboro, May 16, 1891. W. C. Avery.
No. 853 (?). Male. Greensboro, May 16, 1891. W. C. Avery.

44. EREUNETES PUSILLUS (Linnæus).
SEMIPALMATED SANDPIPER.

"Not common. Spring migrant. A specimen, May 26, 1888." (1890d).

No. 859. Male. Greensboro. May 30, 1890. W. C. Avery.
No. 862. Male. Greensboro. May 30, 1890. W. C. Avery.

45. CALIDRIS LEUCOPHÆA (Pallas).
SANDERLING.

The only mention of the sanderling is under date of Sept. 21, 1892, in the Doctor's original notes. He writes: "Sanderling common on the Gulf Shore of Baldwin

(County); many were shot here and on Dauphin Island."

No. 1035. Baldwin Co., near mouth of Perdido Bay. Sept. 21, 1892. W. C. Avery.
No. 1036. Baldwin Co., near mouth of Perdido Bay. Sept. 21, 1892. W. C. Avery.

46. LIMOSA FEDOA (Linnæus).
MARBLED GODWIT.

In 1884 Dr. Avery published the following note on this species in a miscellaneous article addressed to the Editor of the American Field: "I will mention in this connection, that in 1880, in the spring, I shot a rare bird in this county—the great marbled godwit, (*Limosa fedoa*). It was feeding in the mud of a mill-pond, the dam of which had just broken. My attention was attracted by the peculiar manner in which the bird was feeding, thrusting its long bill up to its eyes in the mud, while its tail described an arc of ninety degrees. This pond, abut five mile west of Greensboro, is a favorite resort for birds of the snipe family and water-fowl during the Spring and Fall migrations." (1884).

Evidently speaking of the same individual, he wrote six years later: "A specimen was taken at Cocke's Mill-pond, several years ago during the spring migration. Three only seen." (1890d).

47. TOTANUS MELANOLEUCUS (Gmelin).
GREATER YELLOW-LEGS.

"Not common. Spring and autumn migrant." (1890d).

"Dauphin Island, Sep. 21 (1891); several observed." (Original notes).

48. TOTANUS FLAVIPES (Gmelin).
YELLOW-LEGS.

"March 15th, saw and shot *Totanus flavipes* (lesser yellow shanks)." (1884).

"Not common. Spring and Autumn migrant." (1890d).

"Collected at Cocke's Pond two yellow shanks (*Totanus flavipes*); also Wilson's snipe (*Gallinago delicata*). The

yellow shanks were the first seen this fall." (Original notes. Sept. 16, 1891.)

"Several were taken on the Island (Dauphin) on the 21st (Sept. 1892)." (Original notes).

No. 838. Female. Greensboro. May 9, 1891. W. C. Avery.
No. 839. Male. Greensboro. May 9, 1891. W. C. Avery.

49. HELODROMAS SOLITARIUS SOLITARIUS (Wilson).
SOLITARY SANDPIPER.

"Common. Spring and Autumn migrant. In my collection is a specimen of this bird with label bearing date August 25, 1888; collected two miles west of Greensboro. One peculiarity of this wader is that it sometimes perches upon stumps or fences, near its feeding grounds." (1890d)

No. 465. Male. Greensboro. April 19, 1890. W. C. Avery.
No. 481. Male. Greensboro. April 26, 1890. W. C. Avery.
No. 941. Female. Greensboro. Sept. 29, 1891. W. C. Avery.
No. 1059. Male. Greensboro. May 4, 1893. W. C. Avery.

50. CATOPTROPHORUS SEMIPALMATUS (Gmelin).
WILLET.

Under *Symphemia semipalmata* in Dr. Avery's notes appears:

"Willets were observed on the Island (Dauphin) on the 21st (Sept. 1892); but none were captured."

(51. BARTRAMIA LONGICAUDA (Bechstein).
UPLAND PLOVER.

"Not common. Spring migrant." (1890d).

52. ACTITIS MACULARIA (Linnæus).
SPOTTED SANDPIPER.
"Peetweet."

"March 21, saw *Tringoides macularius* (Spotted Sandpiper)." (1884).

"Summer resident. Not common." (1890d).

No. 116. Male. Greensboro. Apr. 26, 1889. W. C. Avery.
No. 841. Female. Greensboro. May 9, 1891. W. C. Avery.
No. 850. Male. Greensboro. May 16, 1891. W. C. Avery.
No. 852. Male. Greensboro. May 16, 1891. W. C. Avery.

53. NUMENIUS AMERICANUS (Bechstein).
LONG-BILLED CURLEW.

The only mention of this species in Dr. Avery's notes follows:

"Sept. 21, 1892. *Numenius longirostris,* Long-billed curlew, seen on Dauphin Island."

54. SQUATAROLA SQUATAROLA (Linnæus).
BLACK-BELLIED PLOVER.

"Some specimens were obtained several years ago at Cocke's Millpond. None seen since that time." (1890d.)

55. OXYECHUS VOCIFERUS (Linnæus).
KILLDEER.

"The killdeer is a common bird in Alabama. It resides here during the whole year, and is the only one of the plover family, so far as I know, which builds its nest, or I should say—for it lays on the bare ground—rears its young in this vicinity. It lays several eggs on the ground. The young are what ornithologists call 'precoces,' or precocious, that is, running about like little chickens as soon as hatched. It goes in large bands sometimes in the winter; and may be found in low muddy places or upon old commons or bare fields." (Original notes. June 7, 1876). The stomach of a specimen taken on the day of this entry was reported to contain insects.

"Resident. Common. Breeds. A favorite nesting site of this species is on the 'bed' of a cotton or corn row, where it remains undisturbed by the laborer, save to frighten it off the nest once or twice while it is incubating, as he works his growing crop." (1890d).

No. 233. Female. Greensboro. Oct. 5, 1889. W. C. Avery.
No. 827. Male. Greensboro. May 2, 1891. W. C. Avery.
No. 828. Male. Greensboro. May 2, 1891. W. C. Avery.

56. COLINUS VIRGINIANUS VIRGINIANUS (Linnæus).
BOB-WHITE.
"Quail." "Partridge."

"On reading the experience of M. E. Allison with a Bob White I was reminded of an instance of a similar nature of the devotion of a male Bob White to his family duties.

Two years ago, in June, my friend, Dr. J. M. Pickett, an enthusiastic naturalist and a close observer of birds, informed me that a male Bob White had been incubating for some days, and that he constantly occupied the nest. Desiring to be an eye witness of this to me unusual fact, I accompanied the Doctor to the oatfield, where the nest was to be found. After a short search, he walking up one land and I another, I almost trod on the devoted pater-familias, when he fluttered from the nest and stood eyeing me suspiciously, a few feet off. I could not be mistaken as to the sex; the white markings of the head and the white throat attested it. After a few seconds he flew off to the adjoining woods, leaving a dozen white eggs which, in spite of his assiduous care, were not to be warmed into life. He sat upon them so long afterward that Doctor Pickett, suspecting they were spoiled, broke one of them, and finding they could not be hatched, destroyed them all, and put an end to the useless incubation. The female had evidently been killed, and the male returning to the unoccupied nest had taken the place of his mate, and filled it, till the eggs were destroyed." (1889c).

"Abundant still. Resident. Non-migratory. Breeds from first of May 'till first of October. Several broods reared by one pair. The male assists in incubation. It has been recorded by me, in a previous issue of the American Field, that a male Bob White was found incubating by Dr. J. M. Pickett, of Cedarville, Alabama. I rode six miles to witness this novel sight. The Doctor visited the nest frequently for several weeks, and finding that the eggs would not hatch, he destroyed them and relieved this faithful pater-familias from his hopeless endeavor to rear a brood. The female had perhaps been killed, and the male, finding the nest unoccupied, took the place of his mate, but after the eggs were cold and the embryos dead." (1890d).

The stomach of a specimen taken at Greensboro, Nov. 20, 1891, "contained peas and weed seeds."

Among the old Avery papers on file in the State Department of Archives and History, at Montgomery, is an unpublished manuscript on the "Cause of the Scarcity of Game," dated January 5, 1892. It is quoted below in full.

"'Dock Lodge' owns a dropper and shoots partridges; tells me he shoots every day for two or three hours, when he stops for dinner.

"'Ike Woolen' owns a setter; shoots every day.

"Buster Key's son owns an Irish setter; shoots partridges.

"Fred and Ollis Evans shoot partridges; Fred tells me that he and Willie Brown (colored sportsman) went out one day last year and killed thirteen partridges. Fred says—and I believe him—that he and Willie killed more partridges than a party of sportsmen who were shooting the same day.

"'We kept,' said Fred, 'in sight of Mr. Rush; and, when the covies were flushed and scattered, we marked down any birds that flew in our direction, or escaped the notice of Mr. Rush and his friend; and Doctor,' continued Fred, 'we killed more partridges than the party of white men.'

"'Did you kill them all on the wing,' said I.

"'No sir,' said he, 'I killed three out of pine trees where they lit.'

"'"Can you shoot partridges well on the wing?" said I.

"'Yes,' said Fred, 'when a covey rises I generally get one' (I know that Fred and Ollis shoot rabbits well).

"'How many partridges have you killed this season, Fred?'

"'Six. I was hunting rabbits, and the dogs scared up the partridges and I followed them up and shot them. My dogs never pass a flock of partridges without scaring 'em up, and I watch and see where the birds light, and shoot them.'

"Asbury McShann testified as follows: 'I have killed two partridges this year.'

"'Flying,' said I.

"'Yes, but they's hard to kill flying.'

"'How many times have you shot, as near as you can guess?'

"'About a dozen times,' said Asbury.

"Asbury is a poor boy and has not the ammunition to spare; yet he shoots at partridges and wastes his powder

and shot. His desire to become a wing-shot exceeds the wish to save his ammunition.

"Sam Gibson (colored sportsman), owns a pointer and a breech loader. Sam tells me that he has killed up to the first of January eighty partridges. I have no reason to doubt Sam's word, as Asbury McShann says that Sam, at a single shot, killed seven birds out of nine huddled under a bush, on Mr. J. McCrary's 'Jenkins' Place.' Of the two birds escaping, one was badly wounded. I have seen Sam shoot, myself, and I know that he shoots fairly well on the wing.

"Oliver Ward, colored sportsman, bought an Irish setter from John Cocke. Owns a breech loader, shoots birds on the wing. Killed seven on Thanksgiving Day. Why should not Oliver shoot well? He has fired more shots at birds since the emancipation of our slaves than the average white man.

"Jno. Paine (colored sportsman) owns an Irish setter bitch, purchased from Jno. Cocke for five dollars; also other pointing dogs. Oliver Ward informs me that John killed eight or ten partridges on Thanksgiving Day.

"Sol May (colored sportsman) owns a setter bitch or dog; at any rate he owns a pointing dog, for I have seen it. Sol shoots on the wing.

"The three last named gentlemen have exhausted their resources of eloquence to get a dog from me.

"Now Maus William, don't you think you ought to give your old servant a dog?'

" 'My price is twenty-five dollars,' said I, 'for a puppy two months old.' But may ruin overtake me and may my right hand be palsied when it receives a dollar from a 'nigger' for one of my noble dogs!

"Sam Lawson shoots partridges on the wing whenever he has the opportunity. This sportsman when quite small used to hold the horses for the Cobbs boys when they went shooting, and marked down birds for them. Thus he became enamored of field sports and wing shooting especially. Sam hunted many days during the season of '90 and '91 with one of Mr. Cobbs' dogs. Having lived on the place, Sam knew the dog, and thus managed to entice him off either by firing a gun in the neighbor-

hood or by whistling him out of the yard. This Sam continued to do till he was detected and informed that the next time the dog was taken off by him his gun would be appropriated by the owner of the dog.

"Sam killed a good many partridges last season, and up to Christmas 1891 had bagged more than the writer of these notes.

"Woody Lawson shoots partridges when time and opportunity permit. Woody lived many years with Dr. Cobbs and often accompanied him and the boys shooting, hence his love for wing-shooting.

"Ellis Ryan, as all know, shoots partridges and he makes heavy bags—too heavy, alas! for sportsmen to get an equal share of game. The desire to make big bags and to boast about it is doing as much as any other thing to exterminate our partridge. For my part, I take pleasure in saying that I killed on such or such a day two or three or four, or half a dozen birds, as the case may be. Though Ellis is a good shoot, if he confined himself to shooting at the covey on the wing alone, he could not get so many more birds than other shooters; but I have hunted with him and seen him find covey after covey on the ground, when his dog pointed. My presence alone prevented their destruction.

"I have mentioned some of the negro shooters in and around Greensboro who have taken to wing-shooting, to show that the scarcity of birds may be easily accounted for when we take into consideration the fact that the negro, having exterminated the squirrel, has turned his attention to poor little Bob White; and I fear greatly that this game little fellow must soon go the way of the squirrel.

"It is not only around Greensboro, but, if what the negroes themselves tell me can be believed, everywhere in the Blackbelt they are shooting partridges.

"It was not without cause last year, that, discovering this widespread and increasing pursuit (with gun and dog) of our little game bird, I felt that his destruction was not far off, though it has come much sooner than I expected.

"I crossed the river at Erie last year and found the covies in Greene County very small, and far between. Mr. Tunstall had been shooting there, it was told me. The truth is, the negroes were shooting and trapping the birds. Mr. Tunstall nor any other single shooter could perceptibly diminish the number of birds from Millwood to Erie, even if he had hunted every day. 'Many mickles make a muckle' as the Scotch say; it is this everlasting 'shooting of the many'—even though the average of game killed to the gun be small—that must wipe out our game and put an end to sport with gun and dog, unless some means can be devised to protect the birds.

"The drought has been alleged as the cause of the scarcity of birds this year, but I think I have stated the true cause, which will continue in the future, no matter whether the seasons are wet or dry, favorable or unfavorable, if some law is not passed to enable those to protect the birds on their land, who wish to save them from annihilation."

No. ..... Male. Greensboro. Dec. 31, 1891. W. C. Avery.
No. 999. Female. Baldwin Co. Sept. 28, 1892. W. C. Avery.

57. MELEAGRIS GALLOPAVO SILVESTRIS (Vieillot).
WILD TURKEY.

"Twenty years ago the wild turkey, if not common, was not a very rare bird, in this part of Alabama. A drove of turkeys could be found almost anywhere, where there was a considerable body of the primeval forest still standing. They wandered out in every direction from these forests, especially in the breeding season, when the hens would leave their usual haunts in the woods, in search of nesting places. These would be sometimes two or three miles from their habitat, in some sedge field, or some thicket in a piece of woods not usually frequented by wild turkeys. This propensity of the hen to hide her nest from her own kind exposed her to the danger of having her eggs taken, or her young captured sometimes before they could fly.

"One day a young turkey, a few days old, was brought me by a negro who had caught it in the field about a mile

from the house, and two miles from the town of Greensboro. The wild turkey hen had hatched her brood somewhere in this field, where she would remain until fall, when she would take her young to the timbered land on the creek bottoms, two or three miles distant. I raised this young turkey. It proved to be a hen, was very gentle, feeding from my hand, and manifesting, after it was grown, none of the wild instincts of this wildest of birds.

"Another attempt at rearing and domesticating the wild turkey was made with equal success. This time, however, the eggs were hatched, and the young raised by a barnyard hen. I was out one day shooting squirrels, when, in a somewhat frequented spot, and where I should never have thought to find the nest of a wild turkey, a hen rose almost under my feet, and ran off through the woods. Examining the spot that she had just left I discovered her nest in the leaves not three feet from where I was standing. It contained ten eggs, in shape and size not differing from those of the tame turkey. There was no undergrowth in the woods around the nest; but a few bushes and briers grew over it. As I looked at the eggs the idea suddenly suggested itself that I might set these eggs under a domestic hen, and raise the young. I took the eggs from the nest, carried them home carefully, and, incubation having already advanced, they were hatched in about ten days, under a barnyard hen.

"To prevent the young turkeys from running away and being lost—for they are very wild when first hatched—I had an inclosure (of boards) about two feet high and twenty feet square. In the center of this, the hen was confined in a coop. The inclosed space gave the young turkeys room to exercise, and also prevented their escape, till they had lost their natural wildness, and had become gentle enough to feed from the hand, or to allow themselves to be handled without alarm. They were supplied chiefly with animal food in the form of curds, the whey having been pressed from milk after coagulation. They grew and thrived on this diet. Out of nine that were hatched, eight lived to be grown, one dying when about a month old, from a wound inflicted by the spur

of a barnyard cock. Under a different state of affairs these four hens and four cocks might have bred me a large flock of turkeys.

"It was just after our civil war, reconstruction of the states was undergoing its accomplishment, and the freedman, armed with his sham-dam skelp, was ubiquitous; and my turkeys, as well as every other species of game or vermin, were objects of his pursuit. Squirrels were almost exterminated, except in the river bottoms. The mocking-bird, even, did not escape this promiscuous slaughter. I saw one day, on my place, two negro boys, about eighteen years old; they both had guns, and when interrogated as to the species of game their bags contained, they made some evasive answer. I thrust my hand into the sack and drew out four mocking-birds. Indignation seized me, and the reader may imagine that I used some very strong language at this ruthless destruction of a bird that the worst white boy in the South would hestitate to kill.

"My turkeys being very gentle, as I said, and daily attention and feeding from the hand preventing shyness, or any disposition to wander far from home in the breeding season, the hens laid in the yard. Sambo and his sister discovered the nests, and the eggs were stolen. Thwarted thus at first, the four hens wandered far from the house to find a safe retreat for their nests. One flew at least a half a mile every morning before she alighted, and fed along toward her nest, about two miles distant. She returned home to roost late in the evening; but after she went to sitting I did not see her again. She reared a brood, as I afterward learned from a neighbor, who saw, with her, in his field, a young wild turkey nearly grown, and as the field lay in the direction taken by my hen, I inferred that it must be my lost turkey and her brood. One of the other three hens brought home five nearly grown turkeys; but where she nested or how she escaped being killed, I knew not; I did know, however, that she was stolen from the yard fence where she roosted with her family. Silly bird! If she had known Sambo's thievish propensities as well as I knew them, she would have

sought the top of the tallest tree. The other hens did not rear any young. One of them, the following year, laid and hatched a dozen eggs. This time a white boy, the son of a Baptist preacher, who drove his father's cow to pasture every day in a field near my house, took a dozen little turkeys from the mother. The next day he brought his gun with him and shot the old hen. I happened to be in town when this Nimrod marched down the street with my turkey swinging on his back. I was standing across the street, and I heard some one say: "You got her, eh?"I walked across the street and, full of ire, I took my beautiful turkey from the rascal. He did not say a word; he was guilty and made no attempt to defend himself. I found my little turkeys at his reverend sire's but the poor little birds had been starved twenty-four hours, and they all died in spite of my effort to raise them.

"I shall mention one habit of these turkeys, and then I shall close this perhaps already too long communication. Whenever they were threatened by danger, even when a mile from the house, they rose with their loud cry of alarm "put! put! put!" which they never ceased to utter 'till they found themselves safely alighted in the yard. They roosted in a large post oak that had stood for fifty years in the yard, and which may have been a hundred years old. It was ivy-mantled from the ground; the ivy had covered the stem and most of the branches. There at least these persecuted birds were safe, and there their instinct taught them to fly from danger.

"'Seeing that I could not keep my turkeys, I gave to a neighbor one of the cocks, a magnificent bird, so gentle that he allowed himself to be taken while feeding from my hand. The rest of the flock I killed myself.

"Thus went my turkeys; the oak where they roosted is gone; it was blasted by lightning; the hands that planted the ivy and the dear old house itself has vanished from earth, and death and the flames have done their work.

'Return! sad thoughts! return!
I wish to dream and not to weep'." (1886b).

"Common in suitable localities. Resident. Breeds." (1890d).

The last record of observation of the species at Greensboro is contained in the Doctor's original notes for October 25, 1890. In his notes for Sept. 16th-Oct. 2d, 1892, he writes: "Wild turkeys are not uncommon on Perdido Bay; much 'sign' was seen though no birds were observed or taken during my stay."

58. ECTOPISTES MIGRATORIUS (Linnæus).
PASSENGER PIGEON.

"Once countless thousands came in winter to feed upon the mast of our forests. Not one to my knowledge has been seen since the winter of 1887, when Mr. Edward Pasteur, of Greensboro, shot a single specimen in the corporate limits of the town. This bird was not accompanied by any other of his species.

"Since writing the observations above on the passenger pigeon I have been informed that a flock of about two hundred of these birds were seen the first week of November." (1890d).

59. ZENAIDURA MACROURA CAROLINENSIS (Linnæus).
MOURNING DOVE.

Common. Resident. Breeds." (1890d).

In the Doctor's original notes for Baldwin County, Sept. 16th to Oct. 2nd, 1892, appears the following: "*Zenaidura macroura* abundant in the pine woods; feeds on the mast of the long-leaved pine."

No. 1026. Female. Greensboro. Mar. 4, 1893. W. C. Avery.
No. 1087. Female. Greensboro. Oct. 13, 1893. W. C. Avery.

60. CHÆMEPELIA PASSERINA TERRESTRIS (Chapman).
GROUND DOVE.

"Rare. A few examples have been brought to me for identification. Does not breed here that I know." (1890d).

This species is known to breed in Autauga and Montgomery Counties and should certainly breed in Hale County where conditions are not noticeably different.

61. CATHARTES AURA SEPTENTRIONALIS (Wied).
TURKEY VULTURE.
"Turkey Buzzard."

"Common. Resident. Breeds. It is generally not believed that this vulture has the sense of smell acute, but from actual observation I think it must be guided by smell as well as by sight in finding its prey. During the summer past in July a small chicken, about the size of a Bob White, died, and was thrown out of the yard under some pines so dense that no eye could detect so small an object from above. About four days after this chicken had laid there a turkey vulture perched upon a fence near by and extended his neck in different directions, as if "feeling for the scent;" ascertaining the course of the odor, he flew toward the spot, lighted, passed some yards beyond the dead chicken, as a dog that seeks his prey by his olfactories, and then discovering his mistake, he turned and went directly to the object of his search. Mr. C. S. Brimley, this summer, removed the anal glands of a little striped skunk, and threw them about a hundred yards from my door. Several days after this tidbit was exposed, the piercing sight or the keen scent of a turkey vulture discovered its location and the vulture perched on the fence above it; a few minutes afterward he was joined by two others of his species. There they remained for some moments, till one of the number flew down and swallowed the coveted morsel. It seemed to me that the sense of smell guided these vultures in this instance; and no one, who observes them closely, can escape the conclusion that turkey vultures depend much upon the sense of smell to find their prey." (1890d).

62. CATHARISTA URUBU (Vieillot).
BLACK VULTURE.
"Carrion Crow."

"Common. Resident. Breeds." (1890d).

"Saw black vulture feeding her young by regurgitation, as a pigeon." (Original notes. Sept. 1, 1890).

"Found nest of black vulture in a hollow of a tulip tree (*Lyriodendron tulipifera*). The two eggs lay on

the bare ground, there being no nest. The set was sent to the National Museum." (Original notes. April 11, 1891).

63. ELANOIDES FORFICATUS (Linnæus)
SWALLOW-TAILED KITE.

"Not common. Once abundant. It may breed along the Warrior River, where it is now occasionally seen." (1890d).

CIRCUS HUDSONIUS (Linnæus.)
MARSH HAWK.
"Rabbit Hawk."

Concerning this species, Dr. Avery wrote in his notebook: "On March the 17th (1888) flushed a marsh hawk that had just caught a partridge; shot at the hawk and wounded it. This is the first time I ever knew *C. hudsonius* to catch so large a bird." The specimen listed below was shot with a mockingbird in its talons.

"Common. Winter resident." (1890d).

No. 220. Female. Greensboro. Sept. 17, 1889. W. C. Avery.

65. ACCIPITER VELOX (Wilson).
SHARP-SHINNED HAWK.
"Little Blue Darter." "Pigeon Hawk."

A male taken 10 miles west of Greensboro, Nov. 26, 1877, forms the basis of the first journal record of this species. Another specimen, taken Nov. 11, 1887, 10 miles southwest of Greensboro, is of interest because Dr. Avery carefully notes that its "stomach contained remains of vesper sparrow." Of the specimens listed below, the stomach of No. 1025 "contained portion of bird" while that of No. 1038 contained bird debris.

"Not common. Resident. Breeds." (1890d).

No. 261. Female. Greensboro. Nov. 9, 1889. W. C. Avery.
No. 950. Male. Greensboro. Nov. 5, 1891. W. C. Avery.
No. ..... Male. Greensboro. Nov. 6, 1892. W. C. Avery.
No. 1025. Male. Greensboro. Feb. 24, 1893. W. C. Avery.
No. 1038. Female. Greensboro. Apr. 3, 1893. W. C. Avery.

66. ACCIPITER COOPERI (Bonaparte).
COOPER'S HAWK.
"Chicken Hawk." "Big Blue Darter."

The first specimen of this hawk recorded was an adult male taken at Greensboro, Nov. 13, 1877. Ten years later (Aug. 30, 1887) the Doctor launches a tirade, not undeserved, against this species. He writes: "No. 31 was shot while flying across the yard. *A cooperi* is more destructive of game and fowls than any hawk. There is no telling how many pigeons this hawk has taken from me this summer. On the 28th I fired twice at one and in less than 15 minutes it returned and caught a pigeon. Nothing can exceed the daring of Cooper's hawk. While not as swift a flyer as the falcon, it is nevertheless very destructive of fowls and game. I believe it destroys more game and fowls than all the other species of hawks together.

"One for instance has broken up the pigeons in the little box against the gable end of the kitchen: it has caught the old birds (cock and hen) and has caught the young ones also. May my right hand forget her cunning if I kill them not!"

Sept. 13th, following, another specimen was taken, the stomach of which contained "parts of a sand lizard." Under this entry is written: "this hawk was killed *flagrante delicto*. She pursued a pigeon in the yard, knocked it to the ground, and would have captured it but for my presence. She pitched on the limb of a pine just outside of the front gate, when she came to grief by a charge from my gun. Specimen was mounted.

The Doctor evidently delighted in taking a large series of this species. Here is another note, entered Sept. 27, 1887, after the record of No. 35: "This hawk was a large female; raked at pigeons; lit in a pine near the house; flew off into the grove; just as I came out of the house with my gun she circled high over the yard. I cocked and presented, but having in my left hand a chamois skin and a bunch of keys, I found on looking down the barrel to aim at the hawk that the skin obstructed the line of aim; I had to throw it down, recover my aim

and fire. The hawk was flying fast and had made some twenty yards more before I pressed the trigger; she must have been sixty yards from me, but a number five shot took her right wing close to the body, and down she came with the cry of distress peculiar to Cooper's hawk when severely wounded: 'Chiteree! Chiteree! Chiteree!' Whop! She struck the ground loud enough to be heard a hundred yards."

Such wealth of detail seems to indicate that the Doctor derived more than the ordinary collector's pleasure from the taking of specimens of this species. It might be inferred too that he loved his pigeons. But it is now well known that Cooper's hawk is really chargeable with most of the pilfering of poultry yards usually blamed upon the slow-flying, rodent-eating, broad-winged, red-shouldered, and red-tailed hawks.

"Common. Resident. Breeds. This hawk seems to be the greatest enemy of domestic fowls. But above all birds, he seems to prefer the tame pigeon. Two or three times a week my pigeons have to fly for their lives. When very hungry a Cooper's hawk will make repeated attempts at capturing his quarry before he will desist. Several years ago I fired both barrels of my gun at one of these hawks while in pursuit of my pigeons. In less than thirty minutes he returned and carried off a pigeon." (1890d.)

No. 35. Female. Greensboro. Sept. 27, 1887. W. C. Avery.
No. 179. Male. Greensboro. Aug. 1, 1889. W. C. Avery.
No. 232. Female. Greensboro. Sept. 30, 1889. W. C. Avery.
No. 399. Female. Greensboro. Mar. 5, 1890. W. C. Avery.
No. 440. Female. Greensboro. Mar. 12, 1890. W. C. Avery.
No. 812. Male. Greensboro. Feb. 8, 1891. W. C. Avery.
No. 946. Female. Greensboro. Oct. 2, 1891. W. C. Avery.
No. 1020. Male. Greensboro. Feb. 3, 1893. W. C. Avery.

67. BUTEO BOREALIS BOREALIS (Gmelin).
RED-TAILED HAWK.

It is interesting to find that Dr. Avery's first specimen of this bird, taken Jan. 20, 1878, 10 miles west of Greensboro, was sent to Dr. Elliott Coues.

This note, published in 1890, would indicate that the Doctor paid little attention to Oology "Winter resident. Has never been found breeding here to my knowledge."

(1890d). The red-tail is a common breeder in Autauga County and undoubtedly is to be found resident in Hale.

After the entry of speciment No. 1022, listed below, in his catalogue, Dr. Avery wrote the following note on the food of the red-tail that has been amply substantiated by the investigations of Dr. A. K. Fisher of the United States Biological Survey:

The stomach of this buzzard contained mice (*Arvicola pinetorum*) and insects. This red-tailed buzzard is known as the hen hawk. It occasionally preys upon fowls; but the harm it may do by its visits to the farmer's poultry yard is more than compensated by the vermin it destroys. But to the superficial observer a buzzard is a hawk and must atone for his resemblance by his death on all occasions.

"I have examined the contents of many stomachs of this species; and I have yet to find one containing a domestic fowl."

No. 330. Male. Greensboro. Dec. 28, 1889. W. C. Avery.
No. 346. Female. Greensboro. Jan. 4, 1890. W. C. Avery.
No. 350. Male. Greensboro. Jan. 18, 1890. W. C. Avery.
No. 366. Male. Greensboro. Feb. 6, 1890. W. C. Avery.
No. 370. Male. Greensboro. Feb. 12, 1890. W. C. Avery.
No. 1019. Male. Greensboro. Jan. 8, 1893. W. C. Avery.
No. 1021. Male-juv. Greensboro. Feb. 6, 1893. W. C. Avery.
No. 1022. Male. Greensboro. Feb. 9, 1893. W. C. Avery.
No. 1027. Female-juv. Greensboro. Mar. 10, 1893. W. C. Avery.

68. BUTEO LINEATUS LINEATUS (Gmelin).
RED-SHOULDERED HAWK.

The collection contains the following three specimens of the typical subspecies:

No. 189. Female-adult. Greensboro. Aug. 19, 1889. W. C. Avery.
No. 358. Female. Greensboro. Jan. 28, 1890. W. C. Avery.
No. 1109. Male. Greensboro. Dec. 27, 1893. W. C. Avery.

The stomach of No. 1109 contained "remnants of a frog and of grasshoppers."

69. BUTEO LINEATUS ALLENI (Ridgway).
FLORIDA RED-SHOULDERED HAWK.

"Common. Resident. Breeds." (1890d).

As this species is so universally known to the country people as "chicken hawk," it is interesting to note that

the stomach of a specimen (No. 38) taken near Greensboro, Nov. 19, 1887, was "filled with grasshoppers and beetles." The stomach of No. 959, listed below, "contained a good gill of insects and a snake about 6 inches long."

No. 151. Male-juv. Greensboro. May 25, 1889. W. C. Avery.
No. 182. Female-juv. Greensboro. Aug. 10, 1889. W. C. Avery.
No. 188. Male. Greensboro. Aug. 17, 1889. W. C. Avery.
No. 221. Female. Greensboro. Sept. 19, 1889. W.C. Avery.
No. 226. Female. Greensboro. Sept. 28, 1889. W. C. Avery.
No. 279. Female. Greensboro. Nov. 26, 1889. W. C. Avery.
No. 331. Male. Greensboro. Dec. .28, 1889.
No. 959. .Female. Greensboro. Dec. 4, 1891. W. C. Avery.

70. BUTEO PLATYPTERUS (Vieillot).
BROAD-WINGED HAWK.

"Rare. Only one specimen has come under my observation. That was shot and mounted by Dr. J. M. Pickett, of Cedarville, Alabama. I have the specimen in my collection." (1890d).

Unfortunately this specimen has since disappeared.

71. HALIÆETUS LEUCOCEPHALUS LEUCOCEPHALUS (Linnæus).
BALD EAGLE.

"Eight years ago while shooting five miles west of Greensboro, a bald eagle flew over my head at scarcely forty feet high. It took but a second to cock my gun and present, but my horse, for the first time that I had known him, reversed ends as quick as thought; and I found myself with my face and my gun turned in the opposite direction from that which I had intended. The eagle continued on his way and I have not seen him since. My nephew had been shooting from my horse, and had poked the gun between his ears, perhaps, repeated shocks from charges fired too close to his ears, or perhaps grains of powder burning him, had made him gun shy and caused me to lose the only specimen of the bald eagle I ever saw. Moral reflection: Don't lend your horse, or dog, or gun." (1890e).

"Bald eagles were common on the sea coast of Baldwin County." (Original notes. Sept. 16-Oct. 2, 1892.)

72. FALCO PEREGRINUS ANATUM (Bonaparte). Duck Hawk.

The first mention of this species by Dr. Avery is the record of two individuals at Greensboro, Sept. 10, 1886; the last record is of a single bird seen on the Gulf Coast of Baldwin County, Sept. 22, 1892. The species was evidently of considerable interest to the Doctor for he published three articles concerning it. These are quoted here in full.

The first appeared under the title "Wiles of the Peregrine Falcon," and was published in the old "Ornithologist and Oologist which has long since expired. It follows:

"While shooting one day, as I entered a large field, my attention was attracted to a flock of killdeer, flying high over head. They were as noisy as usual and flew in different directions, as if they had been disturbed and scattered.

"Far below the killdeers, came rapidly towards me a peregrine falcon, one eye glancing up at a killdeer many feet above him. His long pointed wings beat the air with short, quick strokes, as they bore him with increasing speed till he reached a point just below his unwary victim, when, as an arrow from a bow, he shot upwards, passing not a foot ahead of the incoming killdeer. The bird literally flew into the outstretched talons that seized and bore it several hundred yards to the top of a tall oak tree.

"Not many minutes had elapsed before I was standing under the tree. A well directed charge of No. 8 shot was launched at the hawk; the killdeer fell from his grasp; he fell to the under side of the limb on which he was perched, quivered a few seconds, released his hold, and followed his dead quarry to the ground.

"On another occasion, I was shooting ducks in a slough in the Warrior bottom, when I heard an unusual noise, so loud and so continued was it that I took it to be the scream of same large bird in distress—a pileated woodpecker perhaps. I hastened towards the place whence the cries proceeded. As I waded into the water, I saw

a peregrine falcon hovering above the timber, as a fish hawk balances himself before he descends. I started a black duck from under a log not ten feet from me; as I proceeded other ducks left their hiding places and sought safety in flight. They were aware of the danger over head in the shape of the falcon, and all the frightful screams of the cunning hawk had not caused them to leave the water. My presence in their very midst had alarmed them and so soon as they were on the wing the falcon darted like lightning after them, and disappeared through the timber with their pursuer close behind them.

"The capture of the killdeer by the falcon, in the manner above described, was certainly astonishing. It was evidently a ruse, as the bird did not see its enemy, 'till like an apparition, he shot up just ahead and the two taloned feet were extended to received it.

"The falcon resorts, also, to cunning when he seeks to frighten the ducks from the water by screams louder than I had supposed it possible for such a bird to make.

"Sometimes the shooter is surprised by the presence of the peregrine falcon as he falls, as it were, from the very clouds.

"Once, upon the coast of North Carolina, near Nay's Head, I had shot several willets and was reloading my muzzle, when a peregrine falcon stooped at a winged willet that stood in the water not twenty yards from me. The wounded bird escaped by squatting suddenly. The upward flight of the falcon seemed to me not less rapid than had been his descent. I had one barrel loaded, the contents of which I sent after him without apparent effect, as he towered in a few seconds beyond the reach of danger.

"One among other occasions, when this marauder has suddenly appeared on the scene, I shall never forget. I had one day scattered a covey of partridges *Colinus virginianus* in an open field, and had hunted the single birds for some time with varied success; now killing, now missing a bird. Finally my dog pointed in a sedge field, at least a half a mile from the nearest woods. I flushed the bird and missed it; almost simultaneously with the shot, a

peregrine falcon stooped from the sky, coming downward and directly behind the whirring partridge, he passed by me swift as the leaden shower I had just sent in vain after poor Bob White; overtaking but missing his quarry before it had flown two hundred yards. It seemed to me that the falcon must have flown with at least four times the speed of the partridge, and that he flew at least a half mile while the latter was going two hundred yards.

That bird was bagged that day by neither shooter nor hawk. I marked it down; but I had not the heart to flush and shoot at it again when it had escaped the leaden missiles hurled after it, and the sharp talons of the hungry falcon that followed in their wake." (1887).

Next came this extended note in "Birds Observed in Alabama":

"Rare. Generally seen in autumn and winter, in the wake of the wild duck. His presence is a good indication that there are ducks somewhere not far distant. It has occurred to me once to see one of these falcons capture a tame pigeon. There were two of them together, tiercel and falcon, male and female, as might be easily seen from their difference in size. They fell like thunderbolts from the clouds; the pigeons, the object of their pursuit, perceived them and took wing; the female falcon leading struck a pigeon and, fastening to it, was borne downward some distance; but, making her hold secure, she rose with her quarry and flew more than half a mile, lighting on the top of a tall gum (liquidambar). Two or three years ago I witnessed another exciting chase of these tigers of the air, after my pigeons. Again came a pair, tiercel and falcon; this time, however, the pigeons discovered their pursuers in time to rise above them. This advantage was not maintained long, for both falcons, following swiftly behind and below their destined quarry, began to "ring" or ascend in rapid circles; the male got his "pitch" first, but before he had attained it, the pigeons were perhaps two hundred yards away and imagined themselves safe; but to close his long, pointed wings, and to dash through their terrified

ranks seemed to me to require but two or three seconds. Indeed, so swift was his flight that the pigeons appeared, in comparison, scarcely to move. He missed his bird, however, and now it was his mate's turn. Pigeons and falcons vanished from my view behind some trees; but they came into sight again in a few seconds, one of the falcons about a quarter of a mile off descending to the ground a few feet behind a pigeon, which was captured without doubt, as escape seemed impossible. What grand sport it would be to have well-trained falcons to pursue our pinnated grouse! Why does not some sportsman take the initiative, who can afford it? Judging from the performances of the wild birds in capturing their prey, shooting game to pointers or setters is tame sport compared with capturing it with falcons." (1890e).

The following was published in 1893 in answer to a question in the "Ornithologist and Oologist":

" 'What is authentically known of the rapidity of flight by different species of birds, and which is considered the swiftest?'

"To Mr. Smith's question, I believe it may be answered that the falcons are the swiftest, and as far as my experience goes it seems to me that the duck hawk is swifter than any other species.

"It easily overtakes any bird within the range of its vision, and does so with incredible velocity.

"A Bob White, once fired at by me, was overtaken by a duck hawk in the distance of two hundred yards, though the hawk apparently had to fly three times as far as its quarry before it reached the latter.

"On another occasion two duck hawks were seen pursuing a flock of tame pigeons. These were far above their pursuers, and while in that position were safe. But the falcons began to 'ring,' or ascend in circles 'till the smaller bird, the male, got his 'pitch' first, then, with astonishing swiftness, he overtook the pigeons, whose rapidity of flight is very great. When the falcon began his swoop, at about an angle of twenty degrees with the flight of the pigeons, these, though going very fast, seemed in comparison with the progress of their pursuer

scarcely to move, as he shot like an arrow through the flock. Other instances of the swiftness of flight by Falcons might be given but these seem to show that no bird flies as fast as the falcon." (1893b).

73. FALCO COLUMBARIUS COLUMBARIUS (Linnæus). Pigeon Hawk.

"Rare. I saw one of these falcons last year pursuing tame pigeons. His performance was poor compared to the brilliant work of the peregrine." (1890e).

The only original reference to this species that could be found is one of the Doctor's Baldwin County notes that is not very authoritative: "While returning from Dauphin Island at dawn on Sept. 22d, a falcon was seen pursuing a tern off the shore of the Gulf. It was supposed from size to be the pigeon hawk." This was in 1892.

The stomach of No. 1106, listed below, "contained remains of a small bird."

No. 947. Female. Greensboro. Oct. 6, 1891. W. C. Avery.
No. 1106. Male-juv. Greensboro. Dec. 22, 1893. W. C. Avery.

74. FALCO SPARVERIUS SPARVERIUS (Linnæus). Sparrow Hawk.

"Common. Resident. Breeds." (1890e).

The stomach contents of an adult male taken Mar. 17, 1888, near Greensboro, were recorded as "grasshoppers and crickets." It is well known that the food of this innocent little hawk consists principally of such insects during the warmer months, while mice enter largely into its bill of fare during the winter, but nevertheless the slaughter of the species continues.

No. 280. Male. Greensboro. Nov. 28, 1889. W. C. Avery.
No. 801. Male. Greensboro. Nov. 1, 1890. W. C. Avery.
No. 953. Male. Greensboro. Nov. 21, 1891. W. C. Avery.
No. 963. Female. Greensboro. Dec. 13, 1891. W. C. Avery.
No. 972. Male. Greensboro. Dec. 26, 1891. W. C. Avery.
No. 1003. Male. Baldwin Co., Oct. 2, 1892. W. C. Avery.
No. 1005. Sex (?). Baldwin Co. Oct. 2, 1892. W. C. Avery.

75. PANDION HALIAETUS CAROLINENSIS (Gmelin).
OSPREY.
"Fish Hawk."

"Observed only a few times by me in this country." (1890e).

The foregoing note was published by the Doctor before his trip to the Gulf Coast in 1892. In his journal for the period Sept. 16-Oct. 2, he writes: "Many ospreys were seen on the Gulf Coast and on Perdido Bay; on Soldier Creek there were many nests in the pines and cypresses."

76. ALUCO PRATINCOLA (Bonaparte).
BARN OWL.

"Rare in this country, as far as I know, except six miles south of Greensboro, on Mr. James Sledge's place, where these owls are abundant. A quantity of their castings may sometimes be gathered under the trees in his grove, where the owls are found. They feed on rats and mice." (1890e).

77. ASIO WILSONIANUS (Lesson)).
LONG-EARED OWL.

"Rare. Three specimens have come under my observation; two shot by Mr. John Cocke of this county and one by myself; flushed in a cornfield on the edge of a thicket, while shooting. Time, winter." (1890e).

The stomach of the specimen listed below "contained hair and bones of mice." A note appended to the entry of this specimen in the Doctor's original catalogue reads: "It was told me that eight or ten of these owls were seen in a flock, and that three or four might have been killed at a shot." A little farther down the page is penned: "On Saturday, March 3d, 1894, a badly shot specimen of *Asio wilsonianus* was brought to me."

No. 1108. Sex (?). Greensboro. Dec. 27, 1893. W. C. Avery.

78. ASIO FLAMMEUS (Pontoppidan).
SHORT-EARED OWL.

"Tolerably common some years; others not seen at all. Frequently flies about in the daytime, and is flushed from the tall grass of meadows and marshes. A half

dozen or more are often seen together. Winter resident." (1890e).

The stomach of the specimen listed "contained a male redwing."

No. 958. Female. Greensboro. Dec. 4, 1891. W. C. Avery.

79. STRIX VARIA VARIA (Barton).
BARRED OWL.

A specimen in the collection, bearing no label, is referable to this subspecies. It is thought to be No. 100, taken by Dr. Avery at Greensboro, Oct. 18, 1888.

80. STRIX VARIA ALLENI (Ridgway).
FLORIDA BARRED OWL.

"Common. Resident. Breeds." (1890e).

No. 835. Female. Greensboro. May 6, 1891. W. C. Avery.
No. 951. Female. Greensboro. Nov. 18, 1891. W. C. Avery.
No. 992. Female-juv. Greensboro. Sept. 7, 1892. W. C. Avery.

81. OTUS ASIO ASIO (Linnæus).
FLORIDA SCREECH OWL*.

The first record found of the screech owl is the journal entry of specimen No. 6 (old series), an adult female taken at Greensboro, June 3, 1876. After a description of the eyes, bill and nails, and a note on the stomach contents, "debris of beetles," is written: "The screech owl is found in Alabama about barns and near dwelling houses. It builds for years in the same hollow tree."

The next specimen was taken just two weeks later, in the same locality, and under the record is appended: "This bird has two plumages which do not characterize either male or female; both being indifferently clad now in one, now in the other: i. e., the male may sometimes be found with a reddish or rufus plumage, and the female may sometimes have the same, sometimes the male may be mottled and then again the female may be mottled. No. 6 is an instance of a female with the rufus plumage, and the present specimen is a female with the mottled plumage."

*Ridgway, Birds of N. and Mid. Am., Part VI, p. 687, Wash. 1914.

The catalogue record shows that the stomach of another specimen, a female taken Dec. 23, 1893, at Greensboro, contained beetles, but the beneficent influence of the screech owl, in spite of the superstition concerning it, is so well known, that its mouse and insect-eating proclivities need not be enlarged upon here. However, it does seem strange that Dr. Avery's only published note on the species should consist of just these three words:

"Common. Resident. Breeds." (1890e).

No. 271. Female. Greensboro. Nov. 13, 1889. W. C. Avery.
No. 527. Male-hornot. Greensboro. May 31, 1890. W. C. Avery.
No. 983. Male. Greensboro. Jan. 27, 1892. W. C. Avery.
No. 1009. Male. Greensboro. Dec. 12, 1892. W. C. Avery.
No. 1011. Male. Greensboro. Dec. 24, 1892. W. C. Avery.
No. 1023. Male. Greensboro. Feb. 21, 1893. W. C. Avery.
No. 1024. Male. Greensboro. Feb. 23, 1893. W. C. Avery.
No. 1037. Male. Greensboro. Feb. 15, 1893. W. C. Avery.

82. OTUS ASIO NÆVIUS (Gmelin).
SCREECH OWL.*

The following specimen is referable to this subspecies:

No. 976. Female. Greensboro. Jan. 18, 1892. W. C. Avery.

83. BUBO VIRGINIANUS VIRGINIANUS (Gmelin).
GREAT HORNED OWL.

"Rare. Resident. Breeds." (1890e).

No. 962. Female. Greensboro. Dec. 8, 1891. W. C. Avery.
No. 990. Male. Greensboro. July 19, 1892. W. C. Avery.
No. ..... Odd specimen with no label.

84. CONUROPSIS CAROLINENSIS (Linnæus).
CAROLINA PAROQUET.

"Has not been seen in this country for many years. Once common." (1890e).

Probably the Doctor had to accept hearsay evidence as to the former abundance of this species, for it is doubtful that he ever saw a Carolina paroquet in life.

85. COCCYZUS AMERICANUS AMERICANUS (Linnæus).
YELLOW-BILLED CUCKOO.
"Rain Crow."

"Common. Summer resident. Breeds." (1890e).

*Ridgway, Birds of N. and Mid. Am., Part VI, p. 690, Wash. 1914.

Sept. 11, 1889, Dr. Avery noted in his journal that he saw "a half dozen yellow-billed cuckoos feeding on cotton worms."

No. 500. Female. Greensboro. May 4, 1890. W. C. Avery.
No. 595. Male. Greensboro. Aug. 22, 1890. W. C. Avery.
No. 604. Male. Greensboro. Aug. 23, 1890. W. C. Avery.

86. CERYLE ALCYON (Linnæus).
BELTED KINGFISHER.

"Common. Summer resident. Breeds." (1890e).

This note is too restricted, for the kingfisher is a permanent resident in Alabama.

The Doctor recorded the species as common on Perdido Bay during his stay in Baldwin County, Sept. 16 to Oct. 2, 1892.

No. 584. Female. Greensboro. Aug. 16, 1890. W. C. Avery.

87. CAMPEPHILUS PRINCIPALIS (Linnæus).
IVORY-BILLED WOODPECKER.

"In 1866, while I was stalking some mallards in the Cypress Slough, near the Warrior River, and ten miles west of Greensboro, a bird which I thought was a pileated woodpecker (called here log-cock), flew by me, but a strange note made me at once suspect the identity of the bird, and in two seconds a female ivory-billed woodpecker instead of the mallards was secured by me. This is the only instance known to me of its occurrence in this country." (1890e).

88. DRYOBATES VILLOSUS AUDUBONI (Swainson).
SOUTHERN HAIRY WOODPECKER.

"Common. Resident. Breeds." (1890e).

No. 174. Male. Greensboro. July 24, 1889. W. C. Avery.
No. 596. Male. Greensboro. Aug. 22, 1890. W. C. Avery.
No. 693. Female. Greensboro. Sept. 20, 1980. W. C. Avery.
No. 713. Female. Greensboro. Sept. 29, 1890. W. C. Avery.
No. 823. Male. Greensboro. Apr. 11, 1891. W. C. Avery.
No. 889. Male. Greensboro. Aug. 11, 1891. W. C. Avery.
No. 1063. Male. Greensboro. Sept. 4, 1893. W. C. Avery.

89. DRYOBATES PUBESCENS PUBESCENS (Linnæus).
SOUTHERN DOWNY WOODPECKER.

"Common. Resident. Breeds." (1890e).

No. 396. Male. Greensboro. Mar. 5, 1890. W. C. Avery.
No. 404. Female. Greensboro. Mar. 10, 1890. W. C. Avery.
No. 428. Male. Greensboro. Mar. 19, 1890. W. C. Avery.
No. 599. Female. Greensboro. Aug. 22, 1890. W. C. Avery.
No. 759. Male-juv. Greensboro. Oct. 16, 1890. W. C. Avery.
No. 777. Male. Greensboro. Oct. 21, 1890. W. C. Avery.

90. DRYOBATES BOREALIS (Vieillot).
RED-COCKADED WOODPECKER.

"Common in the pine woods north of Greensboro. It was discovered last September, the 20th, in a growth of pines, in the Warrior River bottom, near Millwood. Mr. C. S. Brimley of Raleigh, North Carolina, who was making biological explorations here for the Agricultural Department at Washington, discovered it there, where it had previously escaped my observation. Resident. Breeds. (1890e).

The stomachs of a male and female of this species, taken Jan. 4, 1891, near Greensboro, contained, respectively, "red ants" and "insects:"

Red-cockaded woodpeckers were "seen frequently" during the Doctor's stay in Baldwin County, Sept. 16 to Oct. 2, 1892.

No. 692. Male. Greensboro. Sept. 20, 1890. W. C. Avery.
No. 809 (?). Female. No label.

91. SPHYRAPICUS VARIUS VARIUS (Linnæus).
YELLOW-BELLIED SAPSUCKER.

Dr. Avery's first specimen of this woodpecker, so far as the record goes, was taken Jan. 10, 1878, at Greensboro. Oct. 8, 1887, another specimen was recorded whose "stomach contained only ants."

"Common during the autumn migration." (1890e).

No. Bis40. Female. Greensboro. Jan. 10, 1878. W. C. Avery.
No. 230. Male. Greensboro. Sept. 28, 1889. W. C. Avery.
No. 240. Male. Greensboro. Oct. 9, 1889. W. C. Avery.
No. 241. Male. Greensboro. Oct. 9, 1889. W. C. Avery.
No. 403. Male. Greensboro. Jan. ....., 1886. W. C. Avery.
No. 774. Female. Greensboro. Oct. 20, 1890. W. C. Avery.
No. 779. Male juv. Greensboro. Oct. 22, 1890. W. C. Avery.
No. 795. Male. Greensboro. Oct. 25, 1890. W. C. Avery.

92. PHLŒOTOMUS PILEATUS PILEATUS (Linnæus).
PILEATED WOODPECKER.
"Log-Cock."

"Not common, though once abundant. Found in heavily timbered localities; chiefly in the river bottom." (1890e).

Writing of Baldwin County, Sept. 16-Oct. 2, 1892, the Doctor noted: "Pileated woodpecker not common; one specimen was taken at 'Rambler's Rest' on Perdido Bay."

No. 1004. Male. Baldwin Co. Oct. 2, 1892. W. C. Avery.
No. 1063. Female. Greensboro. Sept. 8, 1893. W. C. Avery.

93. MELANERPES ERYTHROCEPHALUS (Linnæus).
RED-HEADED WOODPECKER.
"Shirt-Tail."

After cataloging an adult male taken at Greensboro, June 9, 1876, as No. 14 of his first series, Dr. Avery writes:

"Stomach contained debris of insects, and blackberry seeds.

"When I was a boy the red-headed woodpecker was a very common bird. Thousands of these harmless birds have been destroyed, under the pretext of saving the fruit and the Indian corn. I believe that when they peck into the latter it is to search for a worm that destroys the corn: be that as it may the red-headed woodpecker does more good by the destruction of insects than harm by eating a little fruit or corn even.

"No bird affords a better mark for wanton shooters than this beautiful bird. Thousands perish because they are a good mark for a rifle shot.

"There used to be hundreds in Alabama where there is one now. When we destroy our friends, our enemies, the cotton worms, increase until their number is legion.

"My country thou art doomed! The degraded African destroys every day with ruthless hand thy crown of trees, thy noble forests. Even the mockingbird does not escape the senseless, soulless negro. Not long after the war, I saw two negro boys with guns, both of them at least seventeen or eighteen years old. I asked one of them what he had in his bird-bag. He told me (I think) that

he had a rabbit. I put my hand into his pouch and pulled out—Oh, horrors!—four mockingbirds."

In the summer of 1888 a specimen was catalogued without date, the entry followed by this note:

"My little nephew, Willie Cobbs, shot this bird, a pet, which had nested in my lot. *M. erythrocephalus* (red-headed woodpecker) is scarce in this locality. When I was a boy it was one of the commonest birds of this country."

The foregoing statements are especially interesting in view of the Doctor's terse published note on the species which appeared in 1890: "Abundant. Summer resident. A few remain during the winter. Breeds." (1890e).

It is doubtful that there has been any great diminution in numbers of this woodpecker, in spite of its unwonted persecution, because its natural enemies are comparatively few and with the "deadening" of timber incident upon the opened up of new lands its food supply has been augmented and the number of desirable nesting sites increased.

The present writer deplores with the Doctor the wanton destruction of our beneficial birds, that continues even at this time, but he would point out that the negro is not alone responsible. After more than thirty years of educational work on the part of the United States Department of Agriculture, the ornithological societies, and lesser agencies, it is indeed a sad commentary upon our civilization that our whites still persist in using as targets the protectors of our crops, orchards and forests.

No. 554. Sex (?). Greensboro. July 28, 1890. W. C. Avery.
No. 829. Male. Greensboro. May 2, 1891. W. C. Avery.
,No. 832. Male. Greensboro. May 4, 1891. W. C. Avery.

94. CENTURUS CAROLINUS (Linnæus).
RED-BELLIED WOODPECKER.

After the record of No. 51, listed below, the stomach of which "contained portions of acorns and beetles," occurs this note:

"This bird is common in this country; but like its relative the red-headed woodpecker (*Melanerpes erythrocephalus*) it is becoming every year scarcer."

"Common. Resident. Breeds." (1890e).

Recorded as "quite common" in Baldwin County, Sept. 16 to Oct. 2, 1892.

No. 51Bis. Male. Greensboro. Feb. 7, 1878. W. C. Avery.
No. 638. Male. Greensboro. Sept. 3, 1890. W. C. Avery.
No. 914. Male hornot. Greensboro. Sept. 8, 1891. W. C. Avery.
No. ..... Odd specimen without label.

95. COLAPTES AURATUS AURATUS (Linnæus).
FLICKER.
"Yellow Hammer."

There is only one specimen of the resident subspecies in the collection; it is listed below.

No. 866. Male-hornot. Greensboro. June 13, 1891. W. C. Avery.

96. COLAPTES AURATUS LUTEUS (Bangs).
NORTHERN FLICKER.
"Yellow Hammer."

"Abundant. Winter resident. A few remain during summer and nest here." (1890e).

Subspecies *luteus* was not described until 1898, so the above note was absolutely correct at the time it was published. It is known now, however, that *auratus* is the breeding bird while *luteus* is only a winter visitant.

No. 49Bis. Female. Greensboro. Jan. 28, 1878. W. C. Avery.
No. 318. Female. Greensboro. Dec. 19, 1889. W. C. Avery.
No. 351. Male. Greensboro. Jan. 22, 1890. W. C. Avery.
No. 817. Female. Greensboro. Mar. 24, 1891. W. C. Avery.
No. ..... Odd specimen—no data.

97. ANTROSTOMUS CAROLINENSIS (Gmelin).
CHUCK-WILL'S WIDOW.

Entered under the record of No. 34 (old series), an adult female, taken at Greensboro, Sept. 3, 1877, the stomach of which contained "debris of large beetles," is this note:

"This bird is found in Alabama only in warm weather; appearing here in the spring and leaving on the approach of cold weather. It is insectivorous hence it must go to some climate farther south, where insects abound during our winter."

Of course the Doctor had reference to flying insects such as comprise the food of the goatsuckers.

The stomach of No. 49, listed below, also contained "debris of beetles."

"Common. Summer resident. Breeds." (1890e).

"On May third (1890), shot either a male chestnut sided warbler or a male black-throated green warbler. Lost it. While trying to find it flushed *Antrostomus carolinensis* from her nest. Have since flushed her three times from her nest, and have not yet found that she has carried her egg off in her mouth as Davie quotes Audubon as saying." (Original notes.)

"May 10, 1891. Sent Captain Bendire an egg of the chuck-will's widow. Nest found on the bare ground about a quarter of a mile this side of the Long Bridge, in an oak wood on the north side of the Milwood road.

"June 11, 1891. Set of eggs of *A. carolinensis*, found near the brick church on the Millwood Road; half incubated. Sent to Captain Chas. E. Bendire." (Original notes.)

No. 34Bis. Female. Greensboro. Sept. 3, 1879. W. C. Avery.
No. 49. Male-ad. Greensboro. Apr. 5, 1888. W .C. Avery.
No. 522. Female. Greensboro. May 28, 1890. W. C. Avery.
No. 900. Male-hornot. Greensboro. Aug. 23, 1891. W. C. Avery.

98. ANTROSTOMUS VOCIFERUS VOCIFERUS (Wilson).
WHIP-POOR-WILL.

"Rare. Spring and autumn migrant." (1890e).

Oct. 14, 1890, the Doctor records seeing a whip-poor-will "on a wooded hillside about ½ mile north of Pine Knoll," near Greensboro.

99. CHORDEILES VIRGINIANUS VIRGINIANUS (Gmelin).
NIGHTHAWK.
"Bullbat."

"On Sept. 22, 1887, Dr. Avery "saw large flights of nighthawks late in the evening, flying south; appeared to be a migratory wave." Large numbers were recorded again next day.

"Common. Summer resident. Breeds. Abundant during autumn migration." (1890e).

It is not probable that subspecies *virginianus* breeds in Hale County. Though the specimen listed below was taken in May it could easily have been a migrating bird.

No. 510. Male. Greensboro. May 8, 1890. W. C. Avery.

100. CHORDEILES VIRGINIANUS CHAPMANI (Coues).
FLORIDA NIGHTHAWK.
"Bullbat."

About half of Dr. Avery's only published note on the nighthawk, given under the preceding subspecies, is really applicable to *chapmani* for this is the breeding bird in Hale County. The following breeding record is taken from the Doctor's original notes:

"June 10, 1891. Set of eggs of *Chordeiles virginianus;* incubation advanced; found by a negro on the bare ground in a cottonfield."

No. 533. Female. Greensboro. June 26, 1890. W. C. Avery.
No. 552. Male-hornot. Greensboro. July 26, 1890. W. C. Avery.

101. CHÆTURA PELAGICA (Linnæus).
CHIMNEY SWIFT.

"Abundant. Summer resident. Breeds." (1890e).

No. 196. Female. Greensboro (Millwood). Sept. 7, 1889. W. C. Avery.

102. ARCHILOCHUS COLUBRIS (Linnæus).
RUBY-THROATED HUMMINGBIRD.

That Dr. Avery's enthusiasm was boundless cannot be denied when it is known that his twenty-fifth specimen was a bird of this tiny species. It was taken on that remarkable 17th of June, 1876, when the Doctor put up skins of a number that would have done credit to a more seasoned collector. He writes that he had intended to mount this specimen but had not the necessary wire, so merely made a skin of it.

"Abundant. Summer resident. Breeds." (1890e).

The stomach of a hummer taken Sept. 21, 1893, at Greensboro, "was full of insects."

Hummingbirds were recorded as abundant in Baldwin County, Sept. 16-Oct. 2, 1892.

No. 560. Female. Greensboro. Aug. 11, 1890. W. C. Avery.
No. ..... Female. No data.
No. ..... Male. No data.

103. TYRANNUS TYRANNUS (Linnæus).
KINGBIRD.
"Bee Martin." "Bee-Bird."

The first mention found of this species is under date of June 9, 1876, when Dr. Avery entered in his journal, as No. 15, an adult male taken at Greensboro. He writes:

"Stomach contained insects alone. A most useful bird although he destroys a few bees. Who knows how many thousands of cotton flies this active little bird may destroy? His wings being formed for rapid and powerful flight, he seems to be the terror of carnivorous birds, at least of the heavier and more awkward genera, known by ornithologists as buzzards. The hawk proper or blue-darter as it is stupidly called, would be more than a match for this tyrant."

The following is an entry made sometime in June, 1876 (though not dated), in the Doctor's "Oological Register," as he called it:

"No.5-15 Nest of *Tyrannus carolinensis* (Bee-bird). This nest was far out on one of the later branches of a sweet gum (liquidambar tree). In attempting to pull in the limb and secure the nest, the limb parted company with the stem to which it was attached and threw all the eggs to the ground, very much to my disappointment as it was the first nest of a bee-bird hat I had ever seen. The eggs are white, dotted with reddish specks about the size of a pin point."

"Common. Summer resident. Breeds. This bird is not nearly so destructive to bees as the summer tanager (*Piranga rubra*)." (1890e).

No. 473. Male. Greensboro. April 21, 1890. W. C. Avery.
No. 474. Male. Greensboro. April 21, 1890. W. C. Avery.
No. 488. Male. Greensboro. April 29, 1890. W. C. Avery.
No. 489. Female. Greensboro. April 29, 1890. W. C. Avery.
No. 837. Male. Greensboro. May 8, 1891. W. C. Avery.

104. MYIARCHUS CRINITUS (Linnæus).
CRESTED FLYCATCHER.

"Common. Summer resident. Breeds." (1890e).

"May 31, 1891. Asbury McShan took a nest of *M. crinitus* (Crested flycatcher); set of five, slightly incubated; nest in a hollow mulberry about ten feet from the ground." (Original notes).

No. 458. Male. Greensboro. Apr. 14, 1890. W. C. Avery.
No. 670. Male. Greensboro. Sept. 12, 1890. W. C. Avery.

105. SAYORNIS PHOEBE (Latham).
PHOEBE.

"Common. Winter resident." (1890e).

No. 260. Male. Greensboro. Nov. 5, 1889. W. C. Avery.
No. 309. Male. Greensboro. Dec. 11, 1889. W. C. Avery.
No. 340. Female. Greensboro. Jan. 4, 1890. W. C. Avery.
No. 738. Female. Greensboro. Oct. 7, 1890. W. C. Avery.
No. 808. Male. Greensboro. Dec. 13, 1890. W. C. Avery.
No. 1089. Male. Greensboro. Oct. 15, 1893. W. C. Avery.

106. MYIOCHANES VIRENS (Linnæus).
WOOD PEWEE.

"Abundant. Summer resident. Breeds." (1890e).

Recorded as late as Oct. 24 (1890) at Greensboro.

The stomach contents of an adult male taken June 22, 1888, at Greensboro, were recorded as Hymenoptera and Coleoptera.

No. 516. Male. Greensboro. May 12, 1890. W. C. Avery.
No. 543. Male. Greensboro. July 16, 1890. W. C. Avery.
No. 674. Male. Greensboro. Sept. 16, 1890. W. C. Avery.
No. 753. Male. Greensboro. Oct. 15, 1890. W. C. Avery.

107. EMPIDONAX FLAVIVENTRIS (W. M. & S. F. Baird).
YELLOW-BELLIED FLYCATCHER.

"Rare. There are two specimens in my collection; one taken by C. S. Brimley at Millwood, on September 20 of this year, the other by myself on the 23rd of that month. These are the only examples of this bird that I have met with." (1819a).

No. 691. Male. Greensboro (Millwood). Sept. 20, 1890. W. C. Avery.
No. 1066. Male. Greensboro. Sept. 20, 1893. W. C. Avery.

108. EMPIDONAX VIRESCENS (Vieillot).
ACADIAN FLYCATCHER.

"Common. Summer resident. Breeds." (1891a).

After recording an adult female taken at Greensboro, May 25, 1889, the Doctor noted: "This bird was incubating. Nest of gray moss in a shag-bark tree, 12 ft. from ground; nest suspended by the rim; shallow."

No. 548. Male. Greensboro. July 22, 1890. W. C. Avery.
No. 549. Female. Greensboro. July 22, 1890. W. C. Avery.
No. 573. Male. Greensboro. Aug. 14, 1890. W. C. Avery.
No. 597. Male. Greensboro. Aug. 22, 1890. W. C. Avery.
No. 666. Female. Greensboro. Sept. 11, 1890. W. C. Avery.
No. 696. Male. Greensboro. Sept. 23, 1890. W. C. Avery.
No. 705. Female. Greensboro. Sept. 25, 1890. W. C. Avery.
No. 920. Female. Greensboro. Sept. 10, 1891. W. C. Avery.

109. OCTOCORIS ALPESTRIS ALPESTRIS (Linnæus).
HORNED LARK.

"Only two notes can be found in Dr. Avery's catalogues concerning this species. These follow:

"No. 1012 (listed below was captured from a small flock of six horned larks, form known as prairie; they were feeding in the snow not forty steps from the Greensboro depot. The very cold weather of the season must account for the presence of the horned lark so far south."

"A flock of about a dozen prairie horned larks was seen on the 20th and six of them were captured within fifty yards of the Greensboro station." (This note followed the entry of No. 1012, listed below.)

It will be seen that the Doctor considered all these specimens representatives of the form *praticola*, but Mr. Oberholser of the U. S. Biological Survey refers them to *alpestris*.

No. 1012. Male. Greensboro. Jan. 19, 18993. W. C. Avery.
No. 1013. Female. Greensboro. Jan. 20, 1893. W. C. Avery.
No. 1014. Male. Greensboro. Jan. 20, 1893. W. C. Avery.
No. 1015. Male. Greensboro. Jan. 20, 1893. W. C. Avery.
No. 1016. Female. Greensboro. Jan. 20, 1893. W. C. Avery.
No. 1017. Male. Greensboro. Jan. 20, 1893. W. C. Avery.

110. OCTOCORIS ALPESTRIS PRATICOLA (Henshaw).
PRAIRIE HORNED LARK.

The following specimen, collected from the same flock as the last five listed under the preceding subspecies, has been referred to *praticola* by Mr. Oberholser.

No. 1018. Male. Greensboro. Jan. 20, 1893. W. C. Avery.

111. CYANOCITTA CRISTATA FLORINCOLA (Coues).
FLORIDA BLUE JAY.
"Jaybird."

"Abundant. Resident. Breeds." (1891a).

No. 235. Sex (?). Greensboro. Oct. 8, 1889. W. C. Avery.
No. ..... Male-hornot. Greensboro. July 23, 1891. W. C. Avery.
No. 1040. Female. Greensboro. Apr. 8, 1893. W. C. Avery.
No. ..... Odd specimen—no data.

112. CORVUS BRACHYRHYNCHOS PAULUS (Howell).
SOUTHERN CROW*.

"Abundant. Resident. Breeds." (1891a).

From the following note it would appear that the Doctor occasionally turned his medical skill along avian lines:

"On February 28th (1891) a crow was shot and wounded. The broken wing has been amputated and I hope that he will prove a more amiable captive than the ferocious crow-blackbirds. At this time he seems to have recovered from the wound."

Crows were recorded as abundant in Baldwin County, Sept. 16-Oct. 2, 1892.

No. 224. Male-juv. Greensboro. Sept. 28, 1889. W. C. Avery.
No. 225. Male-ad. Greensboro. Sept. 28, 1889. W. C. Avery.
No. 295. Female-ad. Greensboro. Dec. 7, 1889. W. C. Avery.

113. DOLICHONYX ORYZIVORUS (Linnæus).
BOBOLINK.

"Not common. Spring migrant." (1891a).

The specimens listed below were taken in Carl Tutwiler's oat field; stomachs contained oats and debris of beetles.

No. 137. Female. Greensboro. May 15, 1889. W. C. Avery.
No. 138. Male-ad. Greensboro. May 15, 1889. W. C. Avery.

*Proc. Biol. Soc. Wash., Vol. XXVI, pp. 199-202, Oct. 23, 1913.

114. MOLOTHRUS ATER ATER (Boddaert).
COWBIRD.

In a letter to the Editor of the "American Field," in 1884, Dr. Avery wrote:

"This is the first of the *Icteridae* to appear here, coming early in the Fall." (1884).

In 1891 the following appeared:

"Abundant. Resident from the middle of July till April. This bird not having the care of rearing its young as others, does not seem to tarry long in its northern home." (1891a).

No. 922. Male-hornot. Greensboro. Sept. 14, 1891. W. C. Avery.
No. 949. Male. Greensboro. Nov. 1, 1891. W. C. Avery.

115. AGELAIUS PHŒNICEUS PHŒNICEUS (Linnæus).
FLORIDA RED-WING.

The specimen listed below has been referred to the typical subspecies by Mr. Oberholser.

No. 339. Male. Greensboro. Jan. 3, 1890. W. C. Avery.

116. AGELAIUS PHŒNICEUS PREDATORIUS (Wilson).
RED-WINGED BLACKBIRD.*

"May 28, 1889. Saw several pairs of red-wings, *A. phoeniceus* (Linn.). Found two nests in the marsh north of the Millwood road, on the Bolling Branch. One nest was empty, the other contained a single bird. I could not determine whether the empty nest had been just completed or whether the eggs had been hatched and the young birds had left the nest. One of these nests was three feet from the ground, the other over six. They were bulky structures for so small a bird; both built in button-bushes (*Cephalanthus occidentalis*).

"Visited these nests again on the 31st, and found three nests more in the same marsh. These last were on reeds and in coarse grass, a foot or two from the ground; one of them contained two eggs and a young bird just hatched, the others contained nothing. One of the nests found on the 28th, then empty, contained two eggs on the 31st." (Original notes).

*Mearns, Proc. Biol. Soc. Wash., Vol. XXIV, pp. 226-227, 1911.

"Winter resident. A few remain all the year and nest here. Abundant." (1891a).

No. 69. Male. Greensboro. June 2, 1888. W. C. Avery.
No. 70. Female. Greensboro. June 2, 1888. W. C. Avery.
No. 326. Male. Greensboro. Dec. 23, 1889. W. C. Avery.
No. ..... Male. Greensboro. Jan. 21, 1893. W. C. Avery.

117. STURNELLA MAGNA MAGNA (Linnæus).
MEADOWLARK.
"Oldfield Lark."

It is not certain that the first recorded meadowlark, taken Jan. 26, 1878, was of this subspecies, but as three of the four meadowlarks now in the collection are referable to *magna,* and *argutula* was not described until twenty-one years later, it seems reasonable to place the record here. Dr. Avery records the fact that the stomach of this specimen "contained portions of beetles," and writes that the species is "very common in this state."

It is certain that the northern form is abundant in Alabama during the fall and winter months.

No. 377. Female. Greensboro. Feb. 21, 1890. W. C. Avery.
No. 764. Male. Greensboro. Oct. 18, 1890. W. C. Avery.
No. 1098. Male. Greensboro. Oct. 25, 1893. W. C. Avery.

118. STURNELLA MAGNA ARGUTULA (Bangs).
SOUTHERN MEADOWLARK.

"Abundant. Resident. Breeds." (1891a).

Dr. Avery recorded the meadowlark as "common in the pine woods on Perdido Bay" Sept. 16-Oct. 2, 1892. Possibly both forms were included in his observations.

No. 1032. Female. Greensboro. Mar. 28, 1893. W. C. Avery.

119. ICTERUS SPURIUS (Linnæus).
ORCHARD ORIOLE.

"Abundant. Summer resident. Breeds." (1891a).

No. 20. Male-juv. Greensboro. May 18, 1887. W. C. Avery.
No. 457. Male-juv. Greensboro. Apr. 14, 1890. W. C. Avery.
No. 466. Male-juv. Greensboro. Apr. 19, 1890. W. C. Avery.
No. 475. Male-juv. Greensboro. Apr. 21, 1890. W. C. Avery.
No. 480. Male. Greensboro. Apr. 26, 1890. W. C. Avery.
No. 482. Male. Greensboro. Apr. 26, 1890. W. C. Avery.
No. 834. Female. Greensboro. May 6, 1891.

120. ICTERUS GALBULA (Linnæus).
BALTIMORE ORIOLE.

"Rare. Have observed it only as an autumn migrant." (1891a).

No. 639. Male. Greensboro. Sept. 4, 1890. W. C. Avery.
No. 697. Female. Greensboro. Sept. 23, 1890. W. C. Avery.
No. ..... Odd specimen—no data.

121. EUPHAGUS CAROLINUS (Muller).
RUSTY BLACKBIRD.

"Winter resident. Rare." (1891a).

No. 984. Male. Greensboro. Feb. 28, 1892. W. C. Avery.
No. 985. Female. Greensboro. Feb. 28, 1892. W. C. Avery.
No. 986. Male. Greensboro. Feb. 28, 1892. W. C. Avery.

122. QUISCALUS QUISCULA QUISCULA (Linnæus).
PURPLE GRACKLE.
"Crow Blackbird."

Though Dr. Avery's manuscript notes on the purple grackle are rather voluminous and of considerable interest, his published notes consist of only two or three terse sentences. The first of these appeared in 1884, in a letter to the Editor of the "American Field:" "Obtained specimens of *Scolecophagus cyanocephales* (purple-headed grackle) (March 21st). A few individuals of this species remain here all summer, build nests and rear young." (1884).

The other notes appeared in his "Birds Observed in Alabama—No. 3," published in 1891. These follow just as they were printed:

"Quiscalus quiscula; purple grackle.—Rare, the usual form being intermediate between *quiscula* and *aglæus.*

"Quiscalus quiscula aglaeus; Florida grackle.—Intermediate between *quiscula* and *aglaeus,* but belonging rather to the latter form. Resident. Breeds." (1891a).

The last paragraph is incorrect. All the spring and summer specimens in the collection from the vicinity of Greensboro are referable to subspecies *quiscula.* The only representatives of *aglaeus* found were three specimens from Florida; one collected on Indian River, in 1886, by C. J. Maynard, and two taken at Micco, in 1889, by F. M. Chapman.

The oldest extant specimen of *quiscula* is No. 34, taken Sept. 22, 1887. Its "stomach contained chicken corn, maize and parts of insects." In connection with the food of the bird this note, following the entry of the specimen in the catalog, is of especial interest: "The purple grackle nests here; it is not so common as it was when the country was first settled; forty-five years ago it was one of the greatest pests which the planter had to encounter; it pulled up acres of corn as soon as the leaves appeared above the ground. Children were employed to scare the crow blackbirds from the corn fields, and numbers were shot without apparent diminution of the individuals composing their ranks. The nest of this bird is a coarse structure of sticks daubed with mud. I saw a small colony of purple grackles, in 1876, building their nests in the trees near the Mallory Old Place, Beat 7."

The stomach of another bird, taken May 7, 1889, and presented to the U. S. National Museum, contained crawfish. Still another specimen, shot the same day, had eaten insects. A bird collected June 5, 1889, after dining upon coleopterous insects, had taken dewberries for dessert. The stomach of another, collected next day, contained dewberry seeds and grasshoppers; but the climax is reached in No. 732 (listed below), whose stomach contained acorns. Thus it will be seen that the purple grackle has a very varied dietary.

The following note, appended to the entry of No. 162 in the Doctor's catalogue, under date of June 6, 1889, evidences the fact that he was in no wise free from the usual collector's difficulties: "Measured this young *quiscula* and left it on my table to skin, but the rats carried it off!"

The following notes are taken verbatim and in chronological order from the Doctor's journals:

"April 14, 1890. Found nest of Florida grackle (*Quiscalus quiscula aglaeus*); nest of *Dryobates pubescens* excavated in a willow limb about ten feet from ground; nest of blue gray gnatcatcher (*Polioptila caerulea*) on the horizontal limb of a willow.

"April 18th. Visited these nests; those of the grackles (Q. *q. aglaeus*) were in willow trees; were bulky and built of coarse grass leaves; they were situated close to the body of the tree, and supported by the limbs or sprouts growing from the axis.

"My climber on ascending to these nests found an egg in each of them (*Q. q. Aglaeus*), the other nests were empty.

"25th. Visited the nests of the grackles found on the 14th and 18th. They each contained five eggs. These I collected with the nests and sent to the National Museum.

Measurements of Nests.

No. 23. External width, 6 inches; external depth, 4 inches; internal width, 4.50 inches; internal depth, 3.50 inches.

"May 5th. Found four nests of grackles in pines near Julia Woodruff's, one at the gate about twenty steps from house.

"May 18th. Saw grackles carrying crawfish to their young; their nests were a mile from the grounds where they caught the crawfish.

"June 1st. Found nest of purple grackle in my lot.

"June 1st, 1890. Saw a purple grackle catch a crawfish. This he picked out of shallow water as quickly as a flycatcher would capture an insect on the wing. The crawfish was quite large—his captor flew off about 10 steps from the branch and lighting with his prey began his matin meal by pecking and tearing the crustacean into suitable pieces for swallowing. I approached too near in my eagerness to see the performance, when the grackle flew about a hundred yards, and lighting, continued his eating on the remnant of the crawfish carried with him. I had a good view of *Quiscalus* with my field glass. A red-wing hopped up within a foot of the spot where the feast was being held, and looked wistfully, but respectfully, on till *Q. q. aglaeus* finished and flew off, when *Agelaius phoeniceus* began to consume the fragments. As soon as he had done I walked to the spot and found a

thorax bare of legs, and the 'meat' eaten from the inside of the shell.

"Watched a pair of grackles near the branch till sometime after sunset; in fact the moon was up and shining brightly. I thought they were going to roost on the oak at 'Contentment' gate, but a signal from one being given, they suddenly launched themselves into the air and soon disappeared on their way homeward.

"Just at night the old grackle, with nest in my pasture, brought either a crawfish or a stick to feed her young or complete her nest; I must see the nest to-morrow.

"June 10, 1890. I have two young grackles captured May 20th; they must be about a month old. They began to feed themselves yesterday by taking the bits of hard boiled egg and crawfish, blackberries and earthworms supplied them. They are interesting pets, much attached to me and always recognize my presence by flying against the bars of their prison, or screaming as loud as they can and shaking their wings and stretching their capacious jaws.

"A set of three nestlings of *Q. q. aglaeus* were taken by me, two on the 4th, and one on the 5th of June. The nest was reported to me on the 1st by a little negro, who said that he saw the parents carrying material to build. On the third the little birds were heard crying in the nest and on the 4th two were captured by me and the third nestling, which had left the nest, was taken on the 5th. On the 4th, for positive identification, the parents were both shot.

"On the morning of the 5th I heard a young bird complaining and calling in vain for its parents. It must be rescued; a boy was sought and hired to climb a large oak to catch this one, but search proved fruitless when the boy arrived.

"About an hour later the little starvling had wandered accidentally to my grove near the house, and perched upon the top of a pine, filled the air with its piteous cries for food. Soon it flew from the tree upon the chimney of my house, then upon the roof, where it pursued the pigeons with quivering wings and loud cries for food.

They retreating from this strange apparition, it pursued them to the roof of the pigeon house. It must be caught and fed, poor little famished bird. A long fishing pole dislodged it from the pigeon house. It flew into a pine nearby; scared from this it lighted in another; still pursued by hunger and not knowing where to go, it took a long flight which brought it near to the ground, but still in a pine; another and another time compelled to fly, it left the pine grove and flew to the hillside where its parents had fallen to my gun; again frightened from its perch, a long flight brought it to an oak where it settled on a limb near the ground; once more disturbed, and its wings now weak with constant use, it made about seventy-five yards of trajectory and grappling at the lowest limbs of a willow fell to the ground. The cries of hunger were soon appeased by a bountiful supply and the little captive seems happy with his brothers. Its efforts to escape after it had fallen hungry and tired to the ground were in vain; its feeble wings refused to bear it aloft.

"Why were its parents killed? A problem in ornithology was to be solved. A *pair* of grackles must be collected, and only a mated pair! to prove whether the bronze and Florida grackles interbreed, or whether they belong to different species. Three mated pairs have already been collected, and there has yet been found no crossing of the two species; hence the conclusion is that they do not mate except with their own kind. This was a cruel task and one which will be pursued no more by me. It was done at the suggestion of Professor Robert Ridgway of Washington City."

The next paragraph, dated June 11, 1890, gives the catalog numbers of the six mated birds sent to Mr. Ridgway and the exact localities where the specimens were collected. There is also a short discussion of relationships, but this is substantially the same as the published notes of 1891, already quoted.

"1891. March 22, The crow blackbirds taken on May 20th, 1890, and June 4th and 5th of the same year, lived harmoniously together till they were full grown when

the oldest male killed the other four and fed upon their brains. The door of the cage was found open one morning and the savage bird had escaped to be devoured by the cat; he was never seen after that day: Sic semper tyrannis."

No. 34. Female-juv. Greensboro. Sept. 22, 1887. W. C. Avery.
No. 732. Male. Greensboro. Oct. 4, 1890. W. C. Avery.
No. 441 (?) Male. Greensboro. April 3, 1891. W. C. Avery.
No. 842. Male. Greensboro. May 9, 1891. W. C. Avery.
No. 844. Male. Greensboro. May 12, 1891. W. C. Avery.
No. 845. Female. Greensboro. May 13, 1891. W. C. Avery.
No. 855. Male. Greensboro. May 26, 1891. W. C. Avery.
No. 856. Male. Greensboro. May 28, 1891. W. C. Avery.
No. 863. Female. Greensboro. June 1, 1891. W. C. Avery.
No. 865. Female-hornot. Greensboro. June 2, 1891. W. C. Avery.
No. 868. Female-hornot. Greensboro. June 24, 1891. W. C. Avery.
No. 873. Male-hornot. Anniston. July 3, 1891. W. C. Avery.
No. 874. Female-adult. Anniston. July 3, 1891. W. C. Avery.
No. 876. Male-adult. Anniston. July 3, 1891. W. C. Avery.
No. 877. Male-hornot. Anniston. July 3, 1891. W. C. Avery.
No. 1053. Female. Greensboro. Apr. 29, 1893. W. C. Avery.

123. QUISCALUS QUISCULA ÆNEUS (Ridgway).
BRONZED GRACKLE.

"Professor Ridgway considers this a good species, and he is doubtless right in his belief. Winter resident. Does not breed here." (1891a).

The stomach of specimen No. 173, collected at Greensboro, July 17, 1889, and sent to Mr. Ridgway, contained beetles and grains of oats.

No. 353. Male. Greensboro. Jan. 24, 1890. W. C. Avery.
No. 354. Male. Greensboro. Jan. 24, 1890. W. C. Avery.
No. 359. Female. Greensboro. Jan. 31, 1890. W. C. Avery.
No. 360. Female. Greensboro. Jan. 31, 1890. W. C. Avery.
No. 365. Female. Greensboro. Feb. 3, 1890. W. C. Avery.
No. 1010. Male. Greensboro. Dec. 12, 1892. W. C. Avery.

124. MEGAQUISCALUS MAJOR MAJOR (Vieillot).
BOAT-TAILED GRACKLE.

Writing of his trip to Baldwin County, Sept. 16-Oct. 2, 1892, Dr. Avery records seeing several boat-tails on Dauphin Island, though none were taken.

125. CARPODACUS PURPUREUS PURPUREUS (Gmelin).
PURPLE FINCH.

The stomach of the first recorded bird of this species, a specimen taken at Greensboro, Jan. 14, 1878, "contained debris of berries." The Doctor writes that it is a rare bird.

Four days later, recording another specimen, he write: "Winter visitant; seems to feed on seeds of various trees and weeds. I have seen this bird eating the seeds of the Jamestown weed. This bird is rare in Alabama. He is said to sing well.'

"Common some years; others rare. Winter resident." (1891a).

This little note is found under date of March 15, 1890, in the Doctor's catalog: "The purple finch has been common this winter.

No. 314. Female. Greensboro. Dec. 13, 1889. W. C. Avery.
No. 391. Male. Greensboro. Mar. 2, 1890. W. C. Avery.
No. 392. Female. Greensboro. Mar. 2, 1890. W. C. Avery.
No. 411. Male. Greensboro. Mar. 13, 1890. W. C. Avery.
No. 421. Male. Greensboro. Mar. 15, 1890. W. C. Avery.

126. PASSER DOMESTICUS (Linnæus).
ENGLISH SPARROW.

The Doctor did not deign to waste ink upon this feathered "varmint" though there are two specimens in the collection. The crop of the first contained corn, that of the other "grain."

No. 254. Male. Greensboro. Nov. 2, 1889. W. C. Avery.
No. 255. Female. Greensboro. Nov. 2, 1889. W. C. Avery.

127. ASTRAGALINUS TRISTIS TRISTIS (Linnæus).
GOLDFINCH.

The first goldfinch recorded by Dr. Avery is his No. 17 (old series), an adult female taken at Greensboro, June 10, 1876. He entered in his journal under that date: "This little bird is not very common in this portion of Alabama. In early spring it appears in little flocks, which soon disband, and the note of a solitary bird may be occasionally heard, as he flies over. Even after the season for pairing, they may be seen together in squads of five or six. Do they build their nests and

rear their young in this State. Has the male any song peculiar to the season of love? These are questions that I cannot answer. 'Je ne suis qu'un ane en ornitologie'."

However, he did answer the first question, and also corrected his first statement.

"Common. Resident. Breeds." (1891a).

No. 292. Female. Greensboro. Dec. 3, 1889. W. C. Avery.
No. 349. Female. Greensboro. Jan. 15, 1890. W. C. Avery.
No. 414. Female. Greensboro. Mar. 13, 1890. W. C. Avery.
No. 416. Male. Greensboro. Mar. 13, 1890. W. C. Avery.
No. 417. Male. Greensboro. Mar. 13, 1890. W. C. Avery.
No. 635. Male. Greensboro. Sept. 3, 1890. W. C. Avery.

128. SPINUS PINUS (Wilson).
PINE SISKIN.

"Met with during spring migrations. Abundant in some years, and rare in others." (1891a).

No. 380. Female. Greensboro. Feb. 24, 1890. W. C. Avery.
No. 459. Female. Greensboro. Apr. 14, 1890. W. C. Avery.

129. POŒCETES GRAMINEUS GRAMINEUS (Gmelin).
VESPER SPARROW.

Jan. 26, 1878, the first recorded specimen of this species was taken at Greensboro. Concerning it is written: "Stomach contained small seeds. This bird is a winter visitant."

"Abundant. Winter resident." (1891a).

No. 258. Male. Greensboro. Nov. 5, 1889. W. C. Avery.
No. 1097. Female. Greensboro. Oct. 25, 1893. W. C. Avery.

130. PASSERCULUS SANDWICHENSIS SAVANNA (Wilson).
SAVANNA SPARROW.

"Abundant. Winter resident." (1891a).

No. 129. Male. Greensboro. May 8, 1889. W. C. Avery.
No. 405. Male. Greensboro. Mar. 10, 1890. W. C. Avery.
No. 407. Male. Greensboro. Mar. 11, 1890. W. C. Avery.
No. 798. Male. Greensboro. Oct. 25, 1890. W. C. Avery.
No. ..... Sex (?). Greensboro. Nov. 25, 1893. W. C. Avery.

131. AMMODRAMUS SAVANNARUM AUSTRALIS (Maynard).
GRASSHOPPER SPARROW.
"Yellow-Winged Sparrow."

Dr. Avery's early difficulties in forming an acquaintance with this species but typifies the experience of most

embryonic ornithologists with members of the sparrow family. His journal records of his first specimens are quite interesting and are given here practically in toto. The first, an adult male (No. 16, old series) was taken June 9, 1876, at Greensboro, and presented to the Smithsonian Institution. After recording the measurements, color of feet and bill, and the fact that the stomach contained insects, the Doctor writes: "This is a most interesting specimen to me. I think I recognize in his summer dress an old acquaintance; voice, manners, dress all completely changed. It must be the sparrow that sings so sweetly in the hedges and in the foliage of evergreens in winter. It is possible that this bird spends his summers here and I had never found it out. Go to Washington little fellow. Professor Baird can tell all about you."

A few days later, June 17th, he records an adult female (No. 21, old series) and writes: "This sparrow the same with No. 16, presented to the Smithsonian Institution, resembles most nearly *Passerculus savanna,* the savanna sparrow (Genus 65 of Coues' 'Key to North American Birds'). My specimens differ, however, though not essentially, from the sparrow described in the 'key' as the savanna sparrow. The markings about the breast of mine are not the same.

"'How little we use our eyes is proven to me by the discovery of this sparrow, which I have always taken for the chipping sparrow and should always have done so, if I had not heard his curious insect-like, hardly distinguishable from a cricket's, song. If this is the savanna sparrow he is completely metamorphosed, and close inspection could alone discover the resemblance to that bird. The savanna sparrow has in winter a whistle something like the words 'see! see! see!' much prolonged. Everyone is acquainted with him, who takes notice of anything. Even the flight of my bird is not like that of the savanna sparrow. He flies like a wounded bird especially just before he lights, not with the usual irregular flight of the sparrow, up and down, this side and that side. This however is nothing unusual in the breeding

season, as many birds have a very characteristic flight at that time. My sparrow flies as a *partridge* by constant vertical elevation and depression of the wings. This movement, though is slow and peculiar and may be assumed as that of the turtle-dove or that of *Icteria virens* (yellow-breasted chat) at the period when they are making love. The chat is not only 'chatty' at the season of nesting, but his flight is most amusing. It would make many persons laugh to see him perform his aerial evolutions."

There is a marginal note, written a little later, giving the correct identification of the above specimen. The very next entry is another grasshopper sparrow, taken the same day, indicating that the Doctor was at this time a better collector than an ornithologist. He states that "This as well as that above had debris of insects in stomach."

In August, 1889, Dr. Avery published the following "Observations on the Grasshopper Sparrow in Hale County, Alabama":

"Hale County lies between Tuscaloosa County on the north and Marengo County on the south; its western boundary is the Warrior River, its eastern, Perry County. The grasshopper sparrow, *Ammodromas savannarum passerinus,* is found only in the *Canebrake* or *Black Belt* of Hale County. On its northern migratory path it probably finds there suitable breeding grounds; and that may account for its presence in summer in that part of the county, while it is never seen at all, to my knowledge, in the less fertile, piney and sandy portion of the north of the county.

"It winters farther south, and makes its appearance in this locality about the first of May, when it begins to breed. A nest of this species found by me on the 11th of this month (May) contained five eggs slightly incubated; it was in a depression in the ground, lined with grass, and was arched or domed on the top. The eggs were white and spotted with reddish-brown, mostly on the larger end, and not differing from the description given of the eggs of the grasshopper sparrow breeding farther north.

"The specimens of this sparrow collected by me in this county in the spring and summer have never been streaked, and measurements correspond with the measurements of this species given by Ridgway in his 'Manual.'

"As Mr. Maynard states, a southern grasshopper sparrow may exist, but, if so, it must be farther south than this latitude, which is about the 33d degree north." (1889a).

Two years later this note was included in his "Birds Observed in Alabama": "Common in the black lands. Summer resident. Breeds." (1891a).

It should be stated here that this species is a permanent resident in Alabama.

No. 127. Female. Greensboro. May 8, 1889. W. C. Avery.
No. 128. Male. Greensboro. May 8, 1889. W. C. Avery.
No. 530. Male. Greensboro. June 3, 1890. W. C. Avery.
No. 682. Female. Greensboro. Sept. 17, 1890. W. C. Avery.
No. 957. Male. Greensboro. Nov. 30, 1891. W. C. Avery.

132. PASSERHERBULUS HENSLOWI HENSLOWI (Audubon).
HENSLOW'S SPARROW.

"Rare. On January 12 of this year I took my first and only specimen of this species." (1891a).

The original note in the Doctor's catalog, under date of Jan. 12, 1890, reads: "This specimen was shot to pieces and scarcely enough was left for its identification. It was shot near Myer's Bluff on the Warrior River, while I was shooting partridges."

133. CHONDESTES GRAMMACUS GRAMMACUS (Say).
LARK SPARROW.

"The habitat of this bird, as given in the A. O. U. Check List, is: 'Mississippi valley region, from Ohio, Illinois and Michigan to the Plains, south to Eastern Texas."

"Every summer for the last four or five years, I have seen sparrows with the tail feathers tipped with white. They occur in the black lands southwest of Greensboro, Ala., in bunches or flocks of five or six individuals, as if they might be the family of the parent birds and their young. They are rare, however, as I have met with

them perhaps only once or twice during the summer, and always in July. It has been my misfortune never to secure a specimen of these sparrows, so as to remove all doubt as to their identity. In the summer of 1887, in July, while returning home from a barbecue and shooting match, given by Mr. R. Jeffries, not far from that gentleman's home, two large sparrows, with the tails tipped with white, rose from the grass in front of my horse, and perched on the fence by the road. I had a gun, but no cartridges—at least none that I thought suitable. I returned to Mr. Jeffries' for shells; he had none. I then took two heavily loaded shells, which had already missed fire, and inserted them in my gun, a Lefever semi-hammerless; the gun had weak mainsprings, and I had turned out the screws on the under side of the frame to strengthen the mainsprings. This caused the plungers to project so much from the standing breech that I had to cock the gun to close it. In letting down the hammers, or rather in uncocking the gun, I pressed the triggers before placing my thumb on the lever; the gun was discharged, and eight drams of powder and two and a half ounces of shot drove the butt of the gun with such force against my thigh that I was paralyzed with pain and was *hors de combat* for that day, and for some time after. I was thus disappointed in obtaining the coveted specimen of this to me unknown and rare bird.

"In July of 1886, while on my way to Faunsdale, I saw two miles south of Greensboro, about a half dozen of these sparrows, in an osage orange hedge. I had my gun, and fired at one of the birds, but failed to bag it, as it fell into the dense hedge, it being impossible to reach the spot where it fell, or search for it, on account of the thorns. The other birds disappeared and could not be found.

"In 1885, in July, I saw a bunch of a half dozen of these same sparrows, on the Demopolis road, six miles southwest of Greensboro.

"On July 28, this year, while I was riding, a mile and a half south of Greensboro, a large sparrow, with the white-edged tail, rose from the grass, and lighted on a

weed. My attention was at once attracted by the tail marking, as well as by the peculiar way that it erected the crown-feathers into a crest, as the meadow lark often does. I had no gun this time, but I examined the bird with my field glass, and could see the white superciliary lines and the streaked crown. From the markings of the head and tail, and the size of the sparrow, I identified it as *Chondestes grammacus* (Say), the lark sparrow." (1889b).

"Not common. It has been observed in July and August. It may breed here, though this belief is without other foundation than finding the bird here in July with its young. Found chiefly in the black lands (canebrake), in the southern part of the county." (1891a).

No. 583. Female. Greensboro. Aug. 16, 1890. W. C. Avery.
No. 665. Female. Greensboro. Sept. 11, 1890. W. C. Avery.

134. ZONOTRICHIA ALBICOLLIS (Gmelin).
WHITE-THROATED SPARROW.

The first white-throats are recorded under date of Jan. 20, 1878, when two were taken at Greensboro. The stomach of one "contained seeds" and the other "gravel and Indian corn meal." Concerning them the Doctor wrote: "Winter visitant. One of our commonest sparrows in winter."

In 1891 the following note was published: "Abundant. Winter resident." (1891a).

No. 256. Female. Greensboro. Nov. 4, 1889. W. C. Avery.
No. 319. Male. Greensboro. Dec. 19, 1889. W. C. Avery.
No. 373. Female. Greensboro. Feb. 19, 1890. W. C. Avery.
No. 394. Female. Greensboro. Mar. 2, 1890. W. C. Avery.
No. 813. Female. Greensboro. Mar. 17, 1891. W. C. Avery.
No. 819. Female. Greensboro. Apr. 11, 1891. W. C. Avery.
No. 1102. Female. Greensboro. Oct. 27, 1893. W. C. Avery.

135. SPIZELLA PASSERINA PASSERINA (Bechstein).
CHIPPING SPARROW.

April 6, 1887, Dr. Avery recorded his first chippie with the following note which furnishes an additional example of his early difficulties with the sparrows: "Specimen shot with three others feeding on the ground in a large flock. One of the remaining three was *Spizella pusilla*

(field sparrow). This specimen of the chipping sparrow is the first that I have ever examined closely enough to distinguish it from the field sparrow. I have never found the 'chippey' here in summer. It feeds in large flocks, on lawns in the spring especially."

Naturally one wonders, if this was the first time that the Doctor had distinguished the chipping from the field sparrow, how he could know that it did not occur in summer. That he was not slow to correct his errors is evidenced by this published note: "Common. Resident. Breeds." (1891a).

July 24, 1889, is recorded the observation of an adult male feeding a grasshopper to a young male of the season.

No. 139. Male. Greensboro. May 18, 1889. W. C. Avery.
No. 284. Male. Greensboro. Nov. 30, 1889. W. C. Avery.
No. 294. Male. Greensboro. Dec. 6, 1889. W. C. Avery.
No. 324. Male. Greensboro. Dec. 20, 1889. W. C. Avery.
No. ..... Male-hornot. Greensboro. Aug. 9, 1890. W. C. Avery.
No. 857. Female. Greensboro. May 29, 1891. W. C. Avery.

136. SPIZELLA PUSILLA PUSILLA. (Wilson). FIELD SPARROW.

The first mention of this sparrow is significant in that it reflects the state of the Doctor's knowledge of ornithology at the time. June 17, 1876, he records his first specimen as *Spizella socialis* and writes: "This little bird is very common. It has a very cheerful, and loud song for a bird so small. At the North it is called 'chippie.' It hops about there in the yards and like the robin is very gentle." However, he secured the proper tool (Coues' "Key") and that he made good use of it is evidenced by the fact that the last two sentences were scratched and the following note inserted on the margin: "Since writing this I see my mistake in calling this bird *Socialis*, it is anything but social in its habits. It is *Pusilla*."

The nest and eggs of the field sparrow had been taken prior to the capture of the above specimen. As No. 4 of the "Oological Register," is entered a nest taken June 5, 1876, at Greensboro. Besides the bare record of species, date, and locality, there is the following paragraph: "I had supposed till I found this nest, that this little bird

built its nest always on the ground; because a good many years ago I found the nest of one of this species on the ground, in a sedge field. No. 4 was built in a little shrub by the roadside."

The following note was found under date of April 6, 1887: "My setter puppy swallowed a specimen of *Spizella pusilla*, filled with arsenic. I poured down her throat three heaping tablespoonfuls of salt; Donna vomited the contents of stomach and is now relieved." Even the dog found the sparrows a difficult group!

April 25, 1888, a set of 3 eggs was taken from a nest about 3 feet from the ground in weeds of the last years' growth. These eggs measured: .47 by .67, .48 by .69, and .50 by .70.

The Doctor's only published note is, as usual, very much to the point: "Resident. Breeds. Abundant." (1891a).

No. 425. Female. Greensboro. Mar. 15, 1890. W. C. Avery.
No. 483. Male. Greensboro. Apr. 26, 1890. W. C. Avery.
No. 1104. Sex (?). Uniontown. Nov. 9, 1893. W. C. Avery. Albino.
No. 1105. Female. Greensboro. Dec. 11, 1893. W. C. Avery, Albinistic.

137. JUNCO HYEMALIS HYEMALIS (Linnæus).
SLATE-COLORED JUNCO.

"Common. Winter resident." (1891a).

No. 275. Female. Greensboro. Nov. 23, 1889. W. C. Avery.
No. 276. Female. Greensboro. Nov. 23, 1889. W. C. Avery.
No. 283. Male. Greensboro. Nov. 30, 1889. W. C. Avery.
No. 304. Female. Greensboro. Dec. 10, 1889. W. C. Avery.
No. 323. Male. Greensboro. Dec. 20, 1889. W. C. Avery.
No. 395. Female. Greensboro. Mar. 2, 1890. W. C. Avery.
No. 1099. Male. Greensboro. Oct. 26, 1893. W. C. Avery.

138. PEUCÆA ÆSTIVALIS BACHMANI (Audubon).
BACHMAN'S SPARROW.

Dr. Avery, like others, had trouble identifying his first Bachman's sparrow. July 8, 1886, he collected an adult male which he entered in his catalog as "*S. pusilla*" with the following note: "This bird corresponds nearly with Dr. Coues' description of *S. pusilla* but the yellow at the bend of the wing disagrees with the characters given by

him. I am at a loss how to explain this anomaly." However, he did soon explain the "anomaly," because next day he discovered his mistake and inserted the proper name.

Another specimen was taken May 21, 1887, the stomach of which "contained insects."

The following extended accounts of the nesting of this species appear in the Doctor's notes for 1888:

"8th May. Found nest of *P. ae bachmani;* nest domed; on hill side grown up in old field pines; rear of nest supported by a tuft of coarse grass; the entrance looking upwards at an angle of several degrees; well put together and compact; visited nest several times before I found the parent at home. Although I attempted to catch her on the nest, by going behind and placing my hand over the opening, she fluttered rather than flew out of the nest, running on the ground, and not rising till I had followed her some distance.

"9th. Found nest of *P. ae bachmani* in a patch of old field pines and plum bushes (*Prunus chicasa*). This contained three young and one egg which did not hatch. The old birds were perched on a pine some fifteen steps from me and manifested their alarm at my presence by their nervous movements. A short search revealed this nest with the young birds. This resembled the nest found on the 8th, except that the entrance was somewhat more inclined upwards and not as much concealed by the 2 tufts of grass beside which it was placed.

"May 23rd. Found nest of *P. ae. bachmani* on the slope of a hill covered with old field pines, in an open place, under a fallen pine branch, with some coarse grass growing near it. The parent fluttered from under my feet which had disturbed the nest by striking the pine limb; my left foot touched the right border of the nest and shook the limb before the bird moved. She threw herself on the ground about a foot from me, and then, literally trembling, every feather quivering on her body, her tail spread and wings drooping, after she had gone about ten feet from me she remained in view beside a pine till I at last discovered the nest under my very feet.

All this time she uttered not a sound. When I moved towards her she ran off through the thick weeds and briars; and finally I pursuing she pitched upon a tree and began her 'seep! seep!' till to make identification sure I reluctantly shot but lost her in the dense thicket over which she was perched.

"June 3. Found nest of *P. ae bachmani.* This nest was on a hill covered with loblolly pines (*P. taeda*) and tall grass, but the situation of the nest was open and bare except for some scattered tufts of grass and small Virginia creepers. The entrance to the nest was near the ground and very little inclined to the horizon. As in every case but one where I had found the nest of *bachmani,* the noise made by the alarm of the parent at my presence, attracted my attention, and indicated also to me in this instance where I should search.

"While looking at a 'mimosa' (*Albizzia julibrissin*) and wondering by what agency it had been brought to this unusual spot among the old field pines, a rustling a few feet behind me and the hiss, as I supposed, of a snake, disturbed my meditations. I saw the sparrow and soon the nest, with four young just hatched. The old bird did not fly, but stood 'seeping' about ten feet from me. He had changed his scold into the anxious 'seep! seep' of his vocabulary, 'till I turned towards him, when he ran off through the grass and did not fly until he had led me at least fifteen steps. He then rose and pitched upon a fallen tree top, bobbing up and down much after the fashion of a wren, and while I was examining him with my field glass he broke forth into song, as soft and sweet and full of gladness as that which at times wells from his throat when the shadows of evening creep over his sombre pines.

"This was a beautiful structure, when compared with one which I found on the 23rd of May. This last was scarcely woven into a fabric, and fell to pieces when I lifted it from the ground.

"June 6th. Found nest of *P. ae. bachmani.* This nest when found contained two eggs; it was domed as the previous nests, but was so thin and poorly constructed that I

could see the eggs through the straw as I stood behind it. The parent ran from the nest. I have yet to see one fly as other birds do when disturbed at incubation. They run; some showing great alarm for the safety of their little thatched domicile and its contents and expressing it by a sound resembling more the hissing of a snake than the scolding of a bird. If the intruder follows they continue to run till they have led him some distance from the nest and then they fly upon a tree and begin their 'seep, seep,' all the while accompanying these sounds with movements up and down, or jerking of the body like a wren.

"These birds are terrestrial in their habits, though when flushed they often light in trees. Frequently they rise when disturbed suddenly, with an audible whir which distinguishes them from the field sparrow.

"They sing at all hours of the day; but especially is their song striking and attractive after sunset, and when darkness begins to descend—a prelude of some sweet soul-stirring sounds and then a trill louder and more melodious than that of the field sparrow. This prelude is varied, and relieves the song of monotony; the little musician seems to endeavor to make himself as entertaining as possible, by frequent change in the introductory notes of his strain."

There follow a few more nesting records condensed from the Doctor's note books:

May 12, 1888. Greensboro. Nest on ground between two tufts of broom sedge; contained three young and one egg.

June 29, 1888. Greensboro. Nest in an old field near a loblolly pine, on the edge of a portion of the primitive forest. Four eggs, incubation just begun. "Fayette Sheppard was ploughing when the parent bird flew from under the feet of his oxen. He thought the bird was a snake and struck several times at the place where he had seen it, 'till he discovered the nest."

May 16, 1889, the Doctor found a young Bachman's sparrow that could just fly and a nest with four fresh eggs of the same species.

In view of the extended observation of this bird by Dr. Avery it is strange that his published account should total just these three words: "Common. Resident. Breeds." (1891a). He noted the species in Baldwin County too, between Sept. 16th and Oct. 2, 1892.

Several of the skins and sets of eggs were presented to Capt. Chas. E. Bendire of the Smithsonian Institution.

No. 312. Male. Greensboro. Dec. 13, 1889. W. C. Avery.
No. 347. Male. Greensboro. Jan. 12, 1890. W. C. Avery.
No. 367. Male Greensboro. Feb. 7, 1890. W. C. Avery.
No. 378. Male. Greensboro. Feb. 21, 1890. W. C. Avery.
No. 422. Male. Greensboro. Mar. 15, 1890. W. C. Avery.
No. 513. Male. Greensboro. May 11, 1890. W. C. Avery.
No. 647. Female. Greensboro. Sept. 5, 1890. W. C. Avery.
No. 731. Male. Greensboro. Oct. 4, 1890. W. C. Avery.
No. 734. Female. Greensboro. Oct. 6, 1890. W. C. Avery.

139. MELOSPIZA MELODIA MELODIA (Wilson).
SONG SPARROW.

"Common. Winter resident." (1891a).

No. 263. Female. Greensboro. Nov. 9, 1889. W. C. Avery.
No. 281. Male. Greensboro. Nov. 30, 1889. W. C. Avery.
No. 296. Female. Greensboro. Dec. 8, 1889. W. C. Avery.
No. 321. Female. Greensboro. Dec. 20, 1889. W. C. Avery.
No. 345. Female. Greensboro. Jan. 4, 1890. W. C. Avery.
No. 379. Female. Greensboro. Feb. 21, 1890. W. C. Avery.
No. 410. Female. Greensboro. Mar. 11, 1890. W. C. Avery.
No. 790. Male. Greensboro. Oct. 24, 1890. W. C. Avery.
No. 814. Female. Greensboro. Mar. 17, 1891. W. C. Avery.

140. MELOSPIZA GEORGIANA (Latham).
SWAMP SPARROW.

"Common. Winter resident." (1891a).

A late spring record, May 3, 1891, is found in the Doctor's journal.

No. 268. Male. Greensboro. Nov. 9, 1889. W. C. Avery.
No. 301. Female. Greensboro. Dec. 10, 1889. W. C. Avery.
No. 797. Male Greensboro. Oct. 25, 1890. W. C. Avery.
No. 1087. Male. Greensboro. Oct. 12, 1893. W. C. Avery.

141. PASSERELLA ILIACA ILIACA (Merrem).
FOX SPARROW.

"Not common. Winter resident." (1891a).

After the entries of Nos. 978 and 979 in the Doctor's catalog appear these notes:

"Today (Jan. 19, 1892) we have had the coldest weather for several years; sleet and ground frozen. I have never seen the fox sparrow near any habitation unless it were very cold. In a very cold spell, about 1876, several came into the yard at 'Contentment,' where there were also many more birds than I have seen lately. Nos. 977 and 978 were shot near my house at Pine Knoll, during the very cold weather of the 19th. Craws contained weed seed."

"Saw several fox sparrows today (Jan. 22, 1892)."

No. 310. Male. Greensboro. Dec. 13, 1889. W. C. Avery.
No. 369. Male. Greensboro. Feb. 7, 1890. W. C. Avery.
No. 806. Male. Greensboro. Nov. 19, 1890. W. C. Avery.
No. 977. Male. Greensboro. Jan. 19, 1892. W. C. Avery.
No. 978. Male. Greensboro. Jan. 19, 1892. W. C. Avery.
No. 979. Male. Greensboro. Jan. 22, 1892. W. C. Avery.
No. 981. Male. Greensboro. Jan. 24, 1892. W. C. Avery.
No. 982. Female. Greensboro. Jan. 25, 1892. W. C. Avery.

142. PIPILO ERYTHROPHTHALMUS ERYTHROPHTHALMUS (Linnæus).
TOWHEE.
"Joree."

"Common. Winter resident." (1891a).

No. 966. Female. Greensboro. Dec. 29, 1891. W. C. Avery.

143. PIPILO ERYTHROPHTHALMUS ALLENI (Coues).
WHITE-EYED TOWHEE.

Among the Doctor's Baldwin County notes for the period from Sept. 16th to Oct. 2, 1892, is the following: "Towhee was common; out of five specimens taken one only belonged to *alleni*, the others being typical *Pipilo*." Only three of the Baldwin County specimens are now in the collection, but two are referable to *alleni* and one to *canaster*.

No. 998. Male. Baldwin County. Sept. 27, 1892. W. C. Avery.
No. 1000. Male. Baldwin County. Sept. 29, 1892. W. C. Avery.

144. PIPILO ERYTHROPHTHALMUS CANASTER (Howell).
ALABAMA TOWHEE*.
"Joree."

This is the breeding form in Central Alabama.

*Proc. Biol. Soc. Wash., Vol. XXVI, pp. 199-202, Oct. 23, 1913.

No. 290. Male. Greensboro. Dec. 2, 1889. W. C. Avery.
No. 1001. Female. Baldwin Co. Oct. 1, 1892. W. C. Avery.
No. 1090. Male. Greensboro. Oct. 25, 1893. W. C. Avery.

145. CARDINALIS CARDINALIS CARDINALIS (Linnæus).
CARDINAL.
"Redbird."

Considering how common and easily accessible are the nests of the redbird about the thickets and brier-patches in spring, it is not surprising that Dr. Avery should collect a set of eggs before taking the bird itself. The following is taken from his early "Oological Register.":

"No. 2. Nest of Cardinal Grosbeak (Red-bird)—*Cardinalis virginianus*—27th May, 1876. I discovered, by the twitterings of the parent birds, this nest in a blackberry vine. The cardinal builds its nest on trees or shrubs *near* the *ground*. This nest contained three eggs, the whole 'clutch.' I waited several days after I found it; expecting the old bird to lay another egg;; but finding her constantly on the nest, I became aware that she was sitting."

The small number of eggs laid by the cardinal seems to have interested the Doctor, for in 1890 he published the following under the title "Number of Eggs in a Set of the Cardinal.":

"In Hale county, Alabama, three eggs constitute a complete set of the cardinal. More than three have never been found by me, nor by any one else whom I know in this locality. Dr. J. M. Pickett of Cedarville, Alabama, has had the same experience as myself; he has never collected a set of more than three of the cardinal, although he has taken many sets.

"The cardinal is one of our commonest birds, nesting from early in April till September, and therefore producing more than one set. This bird may lay fewer eggs to the set than in localities farther north, where the nesting period is short, and where one set may be the usual number.

"Davie in *Nests and Eggs of North American Birds* says that the red-eyed vireo lays *three or four eggs;* in this latitude it lays only three. Having, like the cardinal,

a longer time for nesting, it produces fewer eggs to the set, but in all probability lays three more sets than in colder regions. It would be a very great surprise to me to find a set of more than three eggs in a nest of the cardinal or of the red-eyed vireo." (1890c).

The same year he entered in his journal: "This bird (No. 803) had not long finished moulting; there were some pin feathers in his wing. It may be observed in this connection that the cardinal moults very late; and I believe he rears at least two sets of young every season. He may be heard singing late in August when most other birds are silent, as they are losing their feathers and donning a new suit, a process which takes the music out of them."

"Abundant. Resident. Breeds." 1891a).

No. 287. Female. Greensboro. Nov. 30, 1889. W. C. Avery.
No. 288. Male. Greensboro. Nov. 30, 1889. W. C. Avery.
No. 316. Male. Greensboro. Dec. 13, 1889. W. C. Avery.
No. 605. Male-hornot. Greensboro. Aug. 23, 1890. W. C. Avery.
No. 758. Female. Greensboro. Oct. 16, 1890. W. C. Avery.
No. 803. Male. Greensboro. Nov. 2, 1890. W. C. Avery.
No. 908. Male-hornot. Greensboro. Aug. 29, 1891. W. C. Avery.
No. 942. Male. Greensboro. Sept. 29, 1891. W. C. Avery.
No. 974. Male. Greensboro. Jan. 10, 1892. W. C. Avery.
No. 980. Male. Greensboro. Jan. 22, 1892. W. C. Avery.
No. ..... Female. No data.

146. ZAMELODIA LUDOVICIANA (Linnæus).
ROSE-BREASTED GROSBEAK.

"It has been observed only as an autumn migrant. Rare." (1891a).

No. 702. Female. Greensboro. Sept. 25, 1890. W. C. Avery.
No. 1071. Female. Greensboro. Sept. 26, 1893. W. C. Avery.
No. 1076. Female. Greensboro. Oct. 4, 1893. W. C. Avery.
No. ..... Male. No data.

147. GUIRACA CÆRULEA CÆRULEA (Linnæus).
BLUE GROSBEAK.

After cataloging his first specimen of this species, an adult male taken at Greensboro, June 6, 1876, Dr. Avery writes:

"This bird is not common in this part of Alabama. His song, which I have heard only once, is very sweet. He seems to be granivorous, as he may be seen along the edges of oat fields, or in the roads at times —where grain may be found either in the dung of horses or wasted there when carried to mill.

"He is very shy for so small a bird. His call note is a chirp like that of the cardinal grosbeak, with this modification: the chirp of the blue grosbeak is to the chirp of the red-bird as the ring of a silver dollar is to the thump of a copper cent or to that of a nickel.

"The indigo-bird has a note very similar to the chirp of these two grosbeaks, but much feebler.

"The blue-grosbeak disappears from this part of Alabama on the approach of cold weather."

Eleven days later a female, whose "stomach contained grains of wheat and debris of insects," was taken in the same locality.

Early in June, 1888, the Doctor collected a set of four eggs, with nest, from a sweet gum, about three feet from the ground, but unfortunately he neglected to record the exact date. Dimensions of nest: Circumference around rim, 11.50 in.; outside depth 3 in.; inside depth, 1.50 in.; outside diameter, 4 in.; inside diameter, 2.75 in. Materials: "Foundation: dried stems of herbs; then also woven in, portions of snake shed; then leaves of coarse grass woven in with the leaves of deciduous trees; the whole lined with dry grass stems. This nest was on a pine hill in an open locality a few steps from a path."

"Common. Summer resident. Breeds." (1891a).

No. 424. Male. Greensboro. Apr. 18, 1881 (?). W. C. Avery.
No. 568. Male-juv. Greensboro. Aug. 12, 1890. W. C. Avery.
No. 709. Female. Greensboro. Sept. 26, 1890. W. C. Avery.
No. 710. Female. Greensboro. Sept. 26, 1890. W. C. Avery.
No. 854. Male. Greensboro. May 23, 1891. W. C. Avery.

148. PASSERINA CYANEA (Linnæus).
INDIGO BUNTING.
"Indigo Bird."—"Summer Bluebird."

The Doctor's first specimen of this species was an adult male taken at Greensboro, June 3, 1876. Its stomach "contained seeds, sand, and small oblong, white bodies

which I took for seeds not matured." After the entry of the specimen the Doctor wrote:

"This bird is a beautiful blue, which for the want of a better name I have called 'summer blue-bird.' He is found in Alabama during the spring and summer and disappears with cold weather. The female has nothing of the beauty of plumage of the male. She can hardly be distinguished from a sparrow as to color."

Recording the capture of another specimen, July 6, 1886, he writes:

"*C. cyanea* is not a rare bird in this locality. The mate doubtless of this very bird, for several weeks past, perched every morning upon the top of a gum near my door, has made his song heard. It nests here."

April 6, 1887, the Doctor records hearing the song of the first arrival of the season. Oct. 18, 1890, he enters a late record for the species.

"Abundant. Breeds." (1891a).

No. 146. Female-ad. Greensboro. May 22, 1889. W. C. Avery.
No. 164. Male. Greensboro. June 8, 1889. W. C. Avery.
No. 534. Female. Greensboro. June 26, 1890. W. C. Avery.
No. 535. Female-hornot. Greensboro. June 26, 1890. W. C. Avery.
No. 577. Male-hornot. Greensboro. Aug. 15, 1890. W. C. Avery.
No. 578. Male-ad. Greensboro. Aug. 15, 1890. W. C. Avery.
No. 648. Female. Greensboro. Sept. 5, 1890. W. C. Avery.
No. 678. Female. Greensboro. Sept. 15, 1890. W. C. Avery.
No. 831. Male. Greensboro. May 4, 1891. W. C. Avery.
No. 1058. Male. Greensboro. May 4, 1893. W. C. Avery.

149. SPIZA AMERICANA (Gmelin).

DICKCISSEL.

"Black-throated Bunting." "Prairie Lark."

One June 6, 1876, Dr. Avery records his first dickcissel, an adult male taken at Greensboro, as No. 9 of his old series. He remarks: "Stomach contained comminuted fragments of insects, no grain that I could discover.

"This little bird affects the black lands, cane brake and 'prairies.' He is found along the road-sides, where he often builds his nest in the thick foliage of the 'haw,' or other low shrubs and trees.

"Perched upon the top-most spray of tree or shrub by the roadside, his cheerful, but monotonous notes may be

heard during the spring and summer. He disappears on the approach of cold weather."

July 17, 1876, the following record was added to the "Oological Register" as the last entry in that series: "No. 7. Nest of black-throated bunting—*Euspiza americana*. Clutch of four eggs. Two of the eggs fell from the nest and were broken in bringing it home. I found this nest in a small hackberry, a few feet from the ground. These birds build their nests in shrubs or trees, near the ground."

"Common in the black lands in the southern portion of the county. Summer resident. Breeds." (1891a).

No. 514. Male. Greensboro. May 11, 1890. W. C. Avery.
No. 851. Female. Greensboro. May 23, 1891. W. C. Avery.
No. 852. Male. Greensboro. May 23, 1891. W. C. Avery.

150. PIRANGA ERYTHROMELAS (Vieillot).
SCARLET TANAGER.

"Rare. Only observed during the autumn migration. One specimen taken on October 16 last. (1891a).

The species is a fairly common spring migrant in Alabama, and two years after the publication of the foregoing note the Doctor captured No. 1056 listed below.

No. 760. Male. Greensboro. Oct. 16, 1890. W. C. Avery.
No. 924. Male. Greensboro. Sept. 18, 1891. W. C. Avery.
No. 932. Male. Greensboro. Sept. 23, 1891. W. C. Avery.
No. 933. Male. Greensboro. Sept. 24, 1891. W. C. Avery.
No. 943. Male. Greensboro. Oct. 1, 1891. W. C. Avery.
No. 944. Female. Greensboro. Oct. 2, 1891. W. C. Avery.
No. 945. Male. Greensboro. Oct. 2, 1891. W. C. Avery.
No. 1056. Male. Greensboro. May 3, 1893. W. C. Avery.

151. PIRANGA RUBRA RUBRA (Linnæus).
SUMMER TANAGER.
"Summer Redbird."

Dr. Avery did not become acquainted with the home life of this common species until he had reached middle age—another bit of evidence that his interest in the birds was long delayed. But be it said to his credit that when he did undertake the study of ornithology he was thorough.

Under date of June 21, 1875, the fortieth anniversary of his birth, the following paragraph is entered in French

in his journal: "I found to-day in an oak the nest of a tanager. It is the first that I have ever seen."

In the first series of numbers, 13 was an adult male summer tanager shot near Greensboro, June 9, 1876, and later presented to the Smithsonian Institution. Under this entry is written: "Stomach contained debris of insects, was stained internally with the juice of blackberries, and contained some seeds of blackberries.

"Found here in summer and spring. Disappears when its food becomes scarce.

"'*Pyranga rubra*' and '*Pyranga aestiva*' are the same bird. There is quite a variety of plumage in the tanager; some (the males) being red and green, others red having the wings and tail slightly shaded with black." (The variation in the plumage of the summer tanager is one of age and season and occurs only in the male. The female is constantly orange olive-green above, with yellowish orange underparts.)

Among the old journal sheets are three or four pages of "Oological Register," the first entry of which follows in toto:

"No. 1 Nest of *Pyranga rubra*; 26 May, 1876. This nest was found in an oak tree on the Greensboro and Millwood road 1½ miles southwest of Greensboro, and very near 'Contentment.' 'Clutch' of four eggs.

"The nest was built on an oak limb within a few feet of the ground, and overhanging the side of the road. In walking under the limb I frightened the bird, and suspecting that there must be a nest, upon search I found it concealed by the dense foliage; and but for her having flown, the parent bird might have kept the secret, hatched her brood and departed undisturbed with her off-spring to her winter home.

"This bird, called also *Tanagra aestiva*, affects the oak as a building place. He appears in our country early in the spring as soon as his insect food becomes abundant and disappears in the fall with frost. The male may often be seen perched high upon a dead limb of his oak home, where he pours forth his song, not a very melodious one. His notes are rather feeble, but quite sweet.

He reminds one of a young lady who is trying very hard to make herself exceedingly agreeable by singing, but who has but a mediocre voice, and sings always the same song."

A specimen of summer tanager taken June 25, 1888, was presented to Dr. A. K. Fisher of Washington, D. C. This note is interesting because it indicates Dr. Avery's correspondence with noted ornithologists.

"Abundant. Summer resident. Breeds." (1891a).

No. 25. Female. Greensboro. May 21, 1887. W. C. Avery.
No. 163. Male. Greensboro. June 8, 1889. W. C. Avery.
No. 517. Male. Greensboro. May 12, 1890. W. C. Avery.
No. 526. Male. Greensboro. May 31, 1890. W. C. Avery.
No. 585. Female. Greensboro. Aug. 18, 1890. W. C. Avery.
No. 642. Male. Greensboro. Sept. 4, 1890. W. C. Avery.
No. 656. Female. Greensboro. Sept. 6, 1890. W. C. Avery.
No. 699. Female. Greensboro. Sept. 23, 1890. W. C. Avery.
No. 706. Female. Greensboro. Sept. 25, 1890. W. C. Avery.
No. 830. Female. Greensboro. May 3, 1891. W. C. Avery.
No. 904. Female. Greensboro. Aug. 25, 1891. W. C. Avery.
No. 909. Female. Greensboro. Aug. 30, 1891. W. C. Avery.
No. 923. Male. Greensboro. Sept. 17, 1891. W. C. Avery.
No. 940. Male. Greensboro. Sept. 26, 1891. W. C. Avery.
No. 989. Male. Greensboro. Apr. 14, 1892. W. C. Avery.
No. 993. Male-hornot. Greensboro. Sept. 9, 1892. W. C. Avery.

152. PROGNE SUBIS SUBIS (Linnæus).
PURPLE MARTIN.

In a letter to the Editor of the "American Field," in June, 1884, Dr. Avery stated that on March 21st of that year he "Saw also, for the first time this season, *Progne purpurea.*" (1884).

"Common. Summer resident. Breeds." (1891a).

No. 1044. Male. Greensboro (Cocke's Pond). Apr. 15, 1893. W. C. Avery.

153. PETROCHELIDON LUNIFRONS LUNIFRONS (Say).
CLIFF SWALLOW.

"Observed only in the spring; have not found it nesting here." (1891b).

No. 501. Male. Greensboro. May 6, 1890. W. C. Avery.
No. 502. Male. Greensboro. May 6, 1890. W. C. Avery.

154. HIRUNDO ERYTHROGASTRA (Boddaert).
BARN SWALLOW.

"Spring and autumn migrant. Abundant." (1891b).

No. 505. Female. Greensboro. May 7, 1890. W. C. Avery.
No. 506. Male. Greensboro. May 7, 1890. W. C. Avery.
No. 507. Female. Greensboro. May 7, 1890. W. C. Avery.
No. 509. Male. Greensboro. May 7, 1890. W. C. Avery.

155. STELGIDOPTERYX SERRIPENNIS (Audubon).
ROUGH-WINGED SWALLOW.

"Observed in the spring. Not found breeding. Common." (1891b).

Further field work should certainly prove this species to be a common breeder in Hale County.

No. 477. Male. Greensboro. Apr. 23, 1890. W. C. Avery.
No. 478. Female. Greensboro. Apr. 23, 1890. W. C. Avery.
No. 508. Female. Greensboro. May 7, 1890. W. C. Avery.
No. 879. Male. Anniston. July 7, 1891. W. C. Avery.
No. 880. Female. Anniston. July 7, 1891. W. C. Avery.
No. 881. Female-hornot. Anniston. July 7, 1891. W. C. Avery.
No. 882. Hornot. Anniston. July 7, 1891. W. C. Avery.

156. BOMBYCILLA CEDRORUM (Vieillot).
CEDAR WAXWING.
"Cedarbird." "Seal."

This demure little grayish-brown species bears the distinction of furnishing the subject of the first ornithological record to be found in Dr. Avery's papers. Under date of May 23, 1876, is found this entry on a page cut from an old journal:

"No. 1. 3 miles southwest of Greensboro;

"*Ampelis Cedrorum;* male adult;

"Was so fat that I found some difficulty in keeping the skin from being soiled by the grease. His stomach contained a black mulberry. This bird is a migrant, passing a short time with us during the spring."

Here is another original entry, dated April 11, 1890:

"About half an hour before sunset I saw a cedarbird perched on a liquidambar tree. It being unusual to see one of these birds alone, I watched it for some minutes, 'till darkness put an end to my observations. It sat motionless for some minutes on its perch and then sallied forth in pursuit of a passing insect; behaving like a fly-

catcher, except that it changed its perch at each flight taken.

"It finally disappeared in a thicket and I looked in vain to find its roosting place.

"From the shape of the bill of the cedarbird (*Ampelis cedrorum*) it might have been deemed a flycatcher, as it really is if the catching of insects can make it such."

"Winter resident. Common." (1891b).

No. 436. Female. Greensboro. April 1, 1890. W. C. Avery.
No. 437. Female. Greensboro. April 1, 1890. W. C. Avery.
No. 438. Male. Greensboro. April 1, 1890. W. C. Avery.
No. 439. Male. Greensboro. April 1, 1890. W. C. Avery.
No. 780. Male-juv. Greensboro. Oct. 22, 1890.
No. ..... Odd specimen. No data.

157. LANIUS LUDOVICIANUS LUDOVICIANUS (Linnæus).
LOGGERHEAD SHRIKE.
"Butcher-bird."

The first note of interest regarding this species is taken in full from the Doctor's "Oological Register:"

"No. 1. Name: Lanius ludovicianus.

"Locality: Near Greensboro, Alabama.

"Date: 25th April, 1887.

"Collector: Wm. C. Avery, M. D.

"Set 6. Identity: Shot parent. Incubation advanced.

"Nest: In a pine tree near the end of a limb and about 8 ft. from the ground.

"Description of nest. Dimensions of nest: External diameter 7 inches by 7 inches; internal 4 inches by 3¼ inches; depth two and a half inches. The nest is a large structure for so small a bird; the foundation is composed of sticks, some of which are more than a foot long; most of these sticks are from thorn trees—osage orange, plum and honey locust; this frame of coarse sticks supports a quantity of stalks of grass and bits of cotton; the nest is lined with fine bits of grass, cotton and feathers.

"Dimensions of eggs: No. 1 .95 by .75. Dull white; wreathed with confluent blotches about the larger end; color of spots and blotches brownish-black; specked with the same color and having some small spots on the less end and on the sides. No. 2 .96 by .76. Blotched with wreath of blackish-brown about larger end, blotches

spreading more about sides and extending lower than in No. 1. Some indistinct blotching, mingled with well defined spots and specks, reaching to less end; the latter being marked with faint specks. No. 3 .92 by .75. Covered with dark confluent blackish-brown blotches about larger end, the whole end being blotched; specked and spotted on sides with same color; small specks on less end. No. 4. .96 by .74. Blotched about larger end; spotted and specked on sides, the markings growing fewer and smaller at the less end. No. 5 .96 by .74. Thickly blotched at larger end, blotches, spots and specks sparsely scattered over sides and diminishing at less end to small specks. No. 6, .92 by .76. Wreathed with blotches confluent around larger end; some few spots towards less end, the latter specked."

"Common. Resident. Breeds." (1891b).

The loggerhead shrike was seen frequently by the Doctor during his stay in Baldwin County, Sept. 16 to Oct. 2, 1892.

No. 239. Male. Greensboro. Oct. 9, 1889. W. C. Avery.
No. 544. Male-hornot. Greensboro. July 17, 1890. W. C. Avery.
No. 766. Male. Greensboro. Oct. 18, 1890. W. C. Avery.
No. 767. Male. Greensboro. Oct. 18, 1890. W. C. Avery.
No. 915. Female. Greensboro. Sept. 8, 1891. W. C. Avery.
No. 1002. Male. Baldwin Co. Oct. 2, 1892. W. C. Avery.
No. 1034. Female. Greensboro. Mar. 31, 1893. W. C. Avery.

158. VIREOSYLVA OLIVACEA (Linnæus).
RED-EYED VIREO.

Dr. Avery's earlier bird notes are very interesting inasmuch as they throw considerable light upon his progress in ornithology. No. 2 of his old series was a specimen of this common bird, but after carefully recording the sex, measurements, color of eyes, mandibles and tarsi, as was his custom, he writes, under date of May 24, 1876:

"I am little acquainted with this bird. He moves incessantly about among the dense foliage of forest trees where he seems to spend his time entirely. He is a summer resident and must build here, and rear his young. The testicles were much developed; being as large as

garden peas, while those of No. 1, *Ampelis Cedrorum*, were very small; showing that there had been no recent sexual excitement; the latter does not breed in this latitude; at least I have never seen his nest nor his young."

Recording another specimen, No. 18 (old series), under date of June 12, 1876, he writes:

"Stomach contained debris of insects and seeds of berries.

"The red-eyed greenlet, though seldom seen, is not uncommon. He warbles constantly among the dense foliage of the trees which are his home. I know not when he approaches the ground for I have never seen him there."

Under the next entry, No. 19, this note is found:

"This is the second bird of this species shot by me today. Though I have heard the bird and know him when I see him, I have not yet learned to recognize him by his song. This bird has 12 rectrices."

June 17, 1876, an adult female was taken at Greensboro, and the following note entered under the record:

"I secured the nest of this bird. It contained three white eggs, with dark brown specks at the larger end. The eggs are shaped very much like those of the partridge, being 'top-shaped,' shaped like a top."

Referring to this nest in his "Oological Register," Dr. Avery writes:

"It is a pensile nest, and was suspended to the lowest branch of an oak, so near the ground that I could not have walked under it without striking my head. The eggs are shaped very much like those of the partridge 'perdin virginiana' (Aud).

"It is probable that the parent might have laid an egg or two more, as the eggs did not appear to have been set upon. The old bird may have been on the nest for the purpose of laying. The germ of the egg seemed to be unchanged, there being no blood-vessels or no embryo formed."

The same day another specimen was recorded with this note:

"Stomach contained insects. This bird could not be distinguished from the female by the plumage."

On June 22, 1888, the Doctor took a set of three fresh eggs near Greensboro. Nest woven of the inner bark of cedar, lined with pine leaves, a few grass stems, and stems of moss, and bound to the forks of a horizontal branch, about ten feet from the ground, with spider webs and dried "moss" stems. Dimensions: Outside circumference of rim, 8 in.; outside depth, 2½ in; inside depth, 2 in. Measurements of eggs: .72 by .56, .89 by .59, .78 by .58.

"Abundant. Summer resident. Breeds." (1891b).

The species was seen often during the Doctor's visit in Baldwin County, Sept. 16 to Oct. 2, 1892.

No. 473. Female. Greensboro. April 25, 1890. W. C. Avery.
No. 504. Male. Greensboro. May 6, 1890. W. C. Avery.
No. 561. Male. Greensboro. Aug. 11, 1890. W. C. Avery.
No. 579. Male. Greensboro. Aug. 15, 1890. W. C. Avery.
No. 594. Female. Greensboro. Aug. 21, 1890. W. C. Avery.
No. 622. Male Greensboro. Aug. 29, 1890. W. C. Avery.
No. 649. Female. Greensboro. Sept. 5, 1890. W. C. Avery.
No. 768. Male. Greensboro. Oct. 18, 1890. W. C. Avery.

159. LANIVIREO FLAVIFRONS (Vieillot).
YELLOW-THROATED VIREO.

The first recorded specimen of this vireo was taken at Greensboro, June 17, 1876. The stomach contained "a worm and debris of beetles."

"Not common. Has not been observed during the summer by me, though Mr. Henry Young has found it breeding near Greensboro. Three specimens were taken by me last fall." (1891b).

When the Doctor published the foregoing, he must have forgotten his note of June 3, 1888, which follows:

"Saw yellow-throated vireo (Vireo flavifrons). These birds were in a gum thicket in an old field. I examined one carefully with a field glass and saw distinctly the yellow loral stripe and circumorbital ring of yellow, also the yellow extending over chin, throat and breast; and the white wing bars on median and greater coverts."

No. 570. Male. Greensboro. Aug. 14, 1890. W. C. Avery.
No. 661. Male. Greensboro. Sept. 9, 1890. W. C. Avery.
No. 906. Female. Greensboro. Aug. 27, 1891. W. C. Avery.
No. 1046. Male. Greensboro. Apr. 20, 1893. W. C. Avery.

160. LANIVIREO SOLITARIUS ALTICOLA (Brewster).
MOUNTAIN VIREO.

"One example was secured during the migration this fall, the first and only one observed by me." (1891b).

No. 783. Female. Greensboro. Oct. 23, 1890. W. C. Avery.

161. VIREO GRISEUS GRISEUS (Boddaert).
WHITE-EYED VIREO.

The first record of this species was No. 12 of Dr. Avery's old series, an adult male taken at Greensboro, June 8, 1876. The stomach contained "debris of insects and matter which resembled vegetable matter." Four days later he recorded another male, and wrote: "I have not yet learned to distinguish this bird from the preceding (*Vireosylva olivacea*) by his notes. He rarely leaves the lofty tops of the forest trees. He is small but he does not 'roost low'."

This note is a palpable error and is included merely to show that the Doctor was just beginning the study of birds in 1876.

The following is found under date of June 17, 1876:

"This is a noisy little bird, and although smaller than the red-eye, his song is much louder. It is very difficult to find the red-eye on account of the feebleness of its note. Concealed among the dense foliage it sings unseen for hours. I yesterday heard for the first time, *to know it*, the song of *Vireo noveboracensis*, white-eyed vireo."

The following description of No. 31 (old series) taken next day indicates that the Doctor had been studying his "Coues":

"Upper mandible blackish; tip of lower mandible white, bordered posteriorly by a dark, sagittiform portion pointing anteriorly in gonys, and extending outwards and backwards to mandibular tomium, sides of under mandible extending back from gonys proper leaden blue."

"Abundant. Summer resident. Breeds." (1891b).

No. 195. Male. Greensboro. Sept. 7, 1889. W. C. Avery.
No. 551. Male. Greensboro. July 22, 1890. W. C. Avery.
No. 607. Female. Greensboro. Aug. 24, 1890. W. C. Avery.
No. 608. Male. Greensboro. Aug. 24, 1890. W. C. Avery.
No. 633. Female. Greensboro. Sept. 2, 1890. W. C. Avery.

No. 643. Male. Greensboro. Sept. 4, 1890. W. C. Avery.
No. 735. Male. Greensboro. Oct. 6, 1890. W. C. Avery.
No. 769. Female. Greensboro. Oct. 18, 1890. W. C. Avery.

162. MNIOTILTA VARIA (Linnæus).
BLACK AND WHITE WARBLER.

"Not common as a summer resident. Abundant in the autumn migration." (1891b).

No. 545. Male-hornot. Greensboro. July 21, 1890. W. C. Avery.
No. 593. Female. Greensboro. Aug. 21, 1890. W. C. Avery.
No. 1070. Female. Greensboro. Sept. 21, 1893. W. C. Avery.

163. PROTONOTARIA CITREA (Boddaert).
PROTHONOTARY WARBLER.

The following note is Dr. Avery's first record of this species:

"The day (7th May, 1887) was quite cool in the morning, but the thermometer rose towards evening. I was standing near the pond fed by the large Cypress Slough well when I heard the song of a bird which I at first believed to be that of the indigo-bird. After searching for sometime for the author of the pleasing notes that kept resounding through the woods, I saw a prothonotary fly into a tree near the edge of the pond. It was not long before he began to sing and by creeping up I could see his bill vibrate as the notes welled from his throat. I watched him for sometime and to make assurance surer still I shot No. 15, to identify him beyond the question of a doubt."

The stomach of this specimen, taken near Greensboro, contained insects, as did that of another taken May 21, 1887, near the same place.

"Common. Summer resident. Breeds." (1891b).

No. 15 (?). Male. Greensboro. April 5, 1889. W. C. Avery.
No. 1060. Female. Greensboro. Aug. 25, 1893. W. C. Avery.

164. HELINAIA SWAINSONI (Audubon).
SWAINSON'S WARBLER.

"On the 6th of September, while collecting about four miles southwest of Greensboro, Alabama, I took a specimen of Swainson's warbler. As far as I know, this is

the first recorded instance of the capture of this warbler in Alabama." (1890b).

"'On September 6, last, I took the first specimen of this warbler, and the only one that I ever saw. In April of 1878 three specimens of this rare warbler were met with by Mr. N. C. Brown, at Coosada, Elmore county, this State, near the junction of the Coosa and Tallapoosa rivers. He secured two of these warblers. The one captured by me on September 6, last, is then the third specimen taken in this State, and the fourth observed. It was doubless migrating, as the locality where it was shot could hardly have been the summer habitat of Swainson's warbler. About eleven o'clock on that day, as I was walking along the edge of a stream of water flowing from an artesian well, and in a grove of hardwood trees, a number of birds drinking and bathing in this stream flew up from the water. Among them I observed a curious looking little bird that seemed to watch me intently from the crotch of a sapling where he was seated motionless and silent. Without a moment's hesitation I shot the bird, which proved to be Swainson's warbler." (1891b).

No. 652. Female-juv. Greensboro. Sept. 6, 1890. W. C. Avery.

165. HELMITHEROS VERMIVORUS (Gmelin).
WORM-EATING WARBLER.

"Observed during the autumn migrations only. The first was observed last year on August 9, the last on September 19. It cannot be called a common bird, as during the period between these two dates, though I made almost daily observations, I never met, on one day, with more than three specimens of this warbler." (1891b).

No. 193. Male. Greensboro. Sept. 5, 1889. W. C. Avery.
No. 213. Male. Greensboro. Sept. 13, 1889. W. C. Avery.
No. 600. Male. Greensboro. Aug. 23, 1890. W. C. Avery.
No. 609. Female. Greensboro. Aug. 25, 1890. W. C. Avery.
No. 610. Male. Greensboro. Aug. 25, 1890. W. C. Avery.

166. VERMIVORA CHRYSOPTERA (Linnæus).
GOLDEN-WINGED WABRLER.

"Observed, like the preceding species, only during the autumn. First seen this year on August 11, last on October 4. Not common." (1891b).

No. 203. Male. Greensboro. Sept. 11, 1889. W. C. Avery.
No. 204. Male. Greensboro. Sept. 11, 1889. W. C. Avery.
No. 205. Male. Greensboro. Sept. 11, 1889. W. C. Avery.
No. 562. Male. Greensboro. Aug. 11, 1890. W. C. Avery.
No. 729. Female. Greensboro. Oct. 4, 1890. W. C. Avery.
No. 898. Male. Greensboro. Aug. 21, 1891. W. C. Avery.

167. VERMIVORA PEREGRINA (Wilson).
TENNESSEE WARBLER.

"Only one specimen, and that my first, has been taken near Millwood in the Warrior River bottom, on October 4 last." (1891b).

No. 728. Female. Greensboro. Oct. 4, 1890. W. C. Avery.
No. 1092. Female. Greensboro. Oct. 18, 1893. W. C. Avery.

168. COMPSOTHLYPIS AMERICANA AMERICANA (Linnæus).
PARULA WARBLER.

"Common during spring and autumn migrations. A few remain all the summer and breed perhaps, though I have no other evidence of this than that the Parula warbler is a summer resident of Hale County." (1891b).

A couple of years after the publication of the foregoing the Doctor secured all the evidence that he wanted, as testified by the following extended notes taken from his journal for 1893:

"April 9th. Today while making observations on the nest of the yellow-throated warbler found on the 4th, a little bird was seen gathering material from a stump near the water-oak, the nesting site of *D. dominica* No. 2.

"The field glass revealed a female parula warbler. She flew about seventy yards and perched for a moment in a black gum; a second flight took her to the top of a sweet gum; she descended immediately to a pendent bunch of *Tillandsia,* disappeared in the moss, made two or three flights from the tree, always returning to the same place on the tree and entering the same bunch of moss. There could be no doubt as to what she was doing, and I had my first ocular demonstration of the fact that the parula warbler breeds in Hale County, Alabama, though its occurrence here in mid-summer had seemed to me sufficient evidence that it nests in this county.

"The busy little architect was observed sometime at her occupation. She did not always fly in the same direction in search of material, nor did she always light directly on the bunch of moss; she frequently lighted on the top of the sweet gum and descended to her nest. This nest is suspended in the streaming moss, at least two feet under the limb. The moss is woven together, and the nest contains some spider web, as Asbury, who climbed to it, has informed me. Much pleasure is anticipated in taking a full set of this bird's eggs, hitherto unknown to me.

"This little warbler returns from his winter home towards the latter part of March and the first of April. A specimen was taken March 26, 1892; the label contains this observation: 'Male in breeding plumages; testes much enlarged.' This is my earliest record of the arrival of *Compsothlypis americana;* my latest is September 19th, though the latter date is probably not that of the latest occurrence of this bird in Hale County. Some individuals remain with us till the first of October.

"April 10. Another parula was observed today gathering material from a stump on the edge of a field. Fortunately, though she flew at least a hundred and fifty yards into the woods, with the assistance of Asbury her nest was discovered. When she had collected from the stump what she needed and had begun her flight towards her nest, I announced the fact to Asbury who was stationed at least a hundred yards within the woods on the edge of an opening across which she had to fly. So rapid was her flight and so thick the woods when she passed beyond the opening that her destination could not be exactly determined. A certain gum tree covered with gray moss appeared to be the most likely place to find her, but though we watched some time in the morning our little warbler escaped our observation. In the afternoon, however, about four o'clock, we returned and found that she was building in the gum tree. Her nest could be seen through the *Tillandsia* just under a limb about fifteen feet from the ground.

"Another female parula which seemed to be building was seen today but she could not be traced to her nest.

"April 12. Parula still building in West Jones' woods in the gum tree.

"April 23. The parula warbler's nest discovered on the 10th was examined this morning and found to contain four eggs. On being frightened from the nest she seemed much distressed, flying within a few feet of the tree and chirping loudly for so small a bird. She was examined with a powerful field glass, making identification positive. This parula was seen building her nest on the 12th, two days after it was found; allowing two more days for its completion, I conclude that she has laid her set of four eggs in nine or ten days.

"April 24th. The parula warbler's nest discovered to be building on the 10th was taken today and contained four slightly incubated eggs.

"Nest in a sweet gum, 20 ft. from the ground, and on a horizontal limb four feet from the body of the tree.

"The nest had a hole or entrance into the bunch of moss just above its rim; it is suspended in the moss without other support than the moss itself.

"May 10th. This nest of the parula was in an elm tree, forty-five feet from the ground and fifteen feet from the body of the tree. It was found by Asbury on the 28th of April. He saw the female carrying material to build her nest. It was taken just 12 days after the bird was seen building. This bird is probably the same parula that was building first on April 10th, and whose nest was taken on the 23rd, just thirteen days from the time she was first seen building her nest.

"Five days then elapsed from the taking of her nest till the 28th, when she was again found building, and from the 28th of April to the 10th of May, when the second nest was taken, there had passed just twelve days or not two weeks. Seventeen days, or not much over two weeks, transpired between the taking of these two nests of the parula, built I believe by the same bird. From the time the first nest was first seen building 'till the taking the second nest, there passed just thirty days or one month. Then this bird built two nests and laid two sets of eggs in thirty days or one month's time. In

fact in somewhat less than a month, for incubation had begun when the second set was collected."

No. 209. Female. Greensboro. Sept. 11, 1889. W. C. Avery.
No. 569. Female. Greensboro. Aug. 12, 1890. W. C. Avery.
No. 574. Sex (?). Greensboro. Aug. 14, 1890. C. S. Brimley.
No. 665. Male. Greensboro. Sept. 9, 1890. W. C. Avery.
No. 690. Male. Greensboro. Sept. 19, 1890. W. C. Avery.
No. 850. Female. Greensboro. May 23, 1891. W. C. Avery.
No. 910. Male. Greensboro. Sept. 3, 1891. W. C. Avery.
No. 988. Male. Greensboro. Mar. 26, 1892. W. C. Avery.
No. ..... Female. No data.

169. DENDROICA ÆSTIVA ÆSTIVA (Gmelin).
YELLOW WARBLER.

"Spring and autumn migrant. Not common." (1891c).

No. 30 (?). Female. Greensboro. Aug. 10, 1889. W. C. Avery.
No. 449. Male. Greensboro. Apr. 12, 1890. W. C. Avery.
No. 471. Male. Greensboro. Apr. 21, 1890. W. C. Avery.
No. 558. Female. Greensboro. Aug. 11, 1890. W. C. Avery.

170. DENDROICA CORONATA (Linnæus).
MYRTLE WARBLER.
"Yellow-rumped Warbler."

Recording his first specimen of this species, taken Jan. 14, 1878, at Greensboro, the Doctor writes: "Stomach contained debris of cedar berries. Abundant here in the winter and found frequently in company with bluebirds."

"Common. Winter resident." (1891c).

No. 376. Female. Greensboro. Feb. 21, 1890. W. C. Avery.
No. 397. Male. Greensboro. Mar. 5, 1890. W. C. Avery.
No. 413. Female. Greensboro. Mar. 13, 1890. W. C. Avery.
No. 427. Female. Greensboro. Mar. 15, 1890. W. C. Avery.
No. 434. Male. Greensboro. Mar. 26, 1890. W. C. Avery.
No. 435. Male. Greensboro. Mar. 26, 1890. W. C. Avery.
No. 773. Female. Greensboro. Oct. 20, 1890. W. C. Avery.
No. 776. Female. Greensboro. Oct. 21, 1890. W. C. Avery.
No. 781. Female. Greensboro. Oct. 22, 1890. W. C. Avery.
No. 785. Female. Greensboro. Oct. 23, 1890. W. C. Avery.
No. 786. Female. Greensboro. Oct. 23, 1890. W. C. Avery.

171. DENDROICA MAGNOLIA (Wilson).
MAGNOLIA WARBLER.

"Has not been observed in the spring. First seen this fall on the 9th of September, last observed on the 19th of October." (1891c).

No. 698. Female. Greensboro. Sept. 23, 1890. W. C. Avery.
No. 933 (?). Female. Greensboro. Oct. 2, 1890. W. C. Avery.
No. 1073. Male. Greensboro. Sept. 27, 1893. W. C. Avery.
No. 1079. Male. Greensboro. Oct. 8, 1893. W. C. Avery.
No. 1081 (?). Female. Greensboro. Sept. 17, 1893. W. C. Avery.
No. ..... Male. No data.

172. DENDROICA CERULEA (Wilson).
CERULEAN WARBLER.

"Rare. My first acquaintance with this warbler was on May 10, 1887, when I took a pair in the Warrior River bottom, twelve miles southwest of Greensboro. These were the only specimens met with, 'till this fall, when C. S. Brimley took three two miles west of Greensboro, some time between August 9 and 17. I do not recall the exact date. One of these specimens was an adult male, and the others were one male and one female, both young and in fall plumage." (1891c).

A male taken two miles west of Greensboro, March 26, 1890, was recorded as No. 431 in the Doctor's catalogue, but unfortunately it is no longer in the collection.

No. 16. Male-adult. Greensboro. May 10, 1887. W. C. Avery.
No. 17. Female-adult. Greensboro. May 10, 1887. W. C. Avery.

173. DENDROICA PENSLYVANICA (Linnæus).
CHESTNUT-SIDED WARBLER.

"Not common. A spring and autumn migrant. First observed, this year, during the fall migration, on August 29. October 14 last." (1891c).

No. 496. Female. Greensboro. May 4, 1890. W. C. Avery.
No. 619. Female. Greensboro. Aug. 29, 1890. W. C. Avery.
No. 715. Female. Greensboro. Sept. 30, 1890. W. C. Avery.
No. 730. Male. Greensboro. Oct. 4, 1890. W. C. Avery.
No. 903. Male. Greensboro. Aug. 25, 1891. W. C. Avery.
No. 1077. Female. Greensboro. Oct. 4, 1893. W. C. Avery.
No. ..... Female. No data.
No. .... No data.

174. DENDROICA CASTANEA (Wilson).
BAY-BREASTED WARBLER.

The Doctor took a single individual of this, one of the rarer warblers in Alabama, but his note books contain only the bare catalogue entry of the specimen.

No. 1055. Female. Greensboro. May 3, 1893. W. C. Avery.

175. DENDROICA STRIATA (J. R. Forster).
BLACK-POLL WARBLER.

"One individual of this species, the first and only one, was observed eight miles south of Greensboro, May 5, 1889." (1891c).

The Doctor collected the following specimen subsequently to the publication of this note.

No. 1047. Male. Greensboro. April 23, 1893. W. C. Avery.

176. DENDROICA FUSCA (Muller).
BLACKBURNIAN WARBLER.

The following specimen, the only one of the species taken by the Doctor, elicited no further note from him than the bare record in his catalogue.

No. 1054. Female. Greensboro. May 3, 1893. W. C. Avery.

177. DENDROICA DOMINICA DOMINICA (Linnæus).
YELLOW-THROATED WARBLER.

It is interesting to know that specimen No. 1 of Dr. Avery's second series was an adult male of this species taken July 6, 1886, near Greensboro. He writes in his catalogue:

"This bird is quite common in this locality, though captured by me today for the first time. I saw several other individuals at the time of shooting this specimen. They were flitting about in the pine tree with some pine warblers. The yellow-throated warbler must breed here though I have never found the nest."

On the reverse side of label No. 1 was written: "Contents of stomach small beetles and Lepidoptera."

A specimen taken June 25, 1888, was presented to Dr. A. K. Fisher of Washington, D. C.

"Common. Summer resident. Breeds. A nest of this warbler was found by me last spring on May 4. The nest was in a sweet gum tree (*Liquidambar styraciflua*), thirty-five feet from the ground, and was entirely concealed in a bunch of gray moss (*Tillandsia usneoides*). The old bird was seen feeding her young, three in number. The nest contained, besides the young birds, one addled egg." (1891c).

Though the foregoing is the only note on the yellow-throated warbler published by the Doctor, he afterwards recorded rather extended observations on the nesting of the species. These original notes follow:

"April 2, 1893. No. 1. Asbury McShan found a yellow-throated warbler building in a sweet gum tree not far from the Greensboro station, and just over the path, in a pendant bunch of gray moss about forty-five feet from the ground. She could be plainly seen with a field glass through the moss whenever she brought material to the nest.

"On the third and fourth she was occupied morning and evening at her work. At six o'clock she was working on the third; and later still she could be seen 'till almost night at her labor.

"The male was heard singing some distance from the scene of his mate's constant occupation, for many hours; and he seemed quite indifferent to what she was doing, though perhaps she listened to his song attentively, and found relief in the sweet music of her charmer.

"She flew generally to the limb from which the moss hung and ran down till she reached the bunch when she fluttered like a butterfly before the opening on the side of the moss and then vanished in the waving epiphyte, soon to emerge and to dart so swiftly forth that the eye could scarcely follow her as she wound her aerial journey now through the tree tops, and now suddenly descending and skimming along the ground to seek rootlets or straw or vegetable down for her cosy nest. I saw her once tear the lining from an old nest of last year—a brown thrasher's I believe.

"What instinct compels these birds thus to conceal their nests in this pendent moss? Is it the inherited memory of hundreds of ancestors that have built in vain upon the bare branches till they have sought concealment and safety in their rocking cradles upon the tallest trees? Has the cunning serpent or the jay robbed them of their treasures till the instinct of concealment is common to these denizens of the lofty forest trees?

"April 4, 1893. No. 2. Asbury found a nest of *D. dominica* this afternoon. It is in a bunch of *Tillandsia*

usneoides ('gray moss'), suspended from a bough of the water oak (*Quercus aquatica*). This nest is about fifteen feet from the ground. The male was heard singing about a hundred yards from the tree in which his mate had begun nidification. After some search for his quiet partner, she was found on a sweet gum (*Liquidambar styraciflua*). She flew from this into a water oak. There also was another bird. I turned my field glass upon both; the identity of the yellow-throated warbler was positive. Asbury was enjoined to watch her, while the other bird was examined and found to be *V. flavifrons*. While this bird was examined by me, Asbury whispered to me, as he sank on his knees to the ground, 'Sit down, Doctor.' I did so, and at the same time the yellow-throated warbler was seen flitting about a streamer of gray moss. She lingered a few seconds around it, entered it, emerged suddenly, and flew away. She soon returned, however, with a straw in her mouth. Again she entered the moss, again quickly came forth, but this time she was gone ten minutes, or more perhaps. While we were thinking of approaching the moss to examine closely the site of her secret, she returned and disappeared, with the material gathered, by the opening which she had before entered. There could be no doubt as to what she was doing. Another and another time she came and went, and the field glass revealed the outline of the nest and the movements of the busy builder could be seen within, as she moulded the material and wove it into her swinging domicile.

"The male was nowhere to be seen or heard though not long before he was making the woods ring with his cheerful notes. This song is louder and far more musical than that of the pine warbler, in fact the efforts of the latter cannot be called music.

"The yellow-throated warbler is a summer resident of Hale County. He arrives from his winter home from the first to the twelfth of March. The latter date was that of the first song of this bird heard by me this season. It seems now—the 4th of April—to be building, as the observations made by me this spring lead me to believe.

"It seems to be from three weeks to a month later at nidification than the pine warbler, a resident.

"April 10, 1893. No. 3. Late this afternoon, as the sun was setting, quite a number of yellow-throated warblers were seen in some pines near a 'branch' on the edge of a field. I have never before seen so many individuals of this species together. They were watched closely and one of them was seen flying to a bunch of moss on a sweet gum tree (*Liquidambar*). She soon darted out from the moss, and swift as an arrow, glided along the ground into the field. Returning to the same limb on the gum tree, she could be seen on her almost completed nest, partially concealed by the moss but much more easily detected than Nos. 1 and 2 of the same species, already recorded. The nest lay on the limb, the moss forming a canopy above it, but not hiding it from the eye as the bird turned herself around in her cup-shaped fabric, spending several minutes in giving the final touches to her work—for she seemed to be lining it.

"April 18. This morning in attempting to take the nest of *D. dominica* about fifty feet from the ground, recorded above as No. 1, Asbury broke the eggs. About twelve days had elapsed from the completion of the nest when the attempt was made to take it. The broken shells disclosed small embryos.

"The nest was built on a limb in the moss and was almost completely concealed. The outside material of the nest is strips of bark and a light colored or grayish substance resembling spider webs. Inside of this are fine straws interwoven, the whole lined with cow hair and a few horse hairs, and feathers of the robin (*Merula migratoria*).

"External width of nest 2.70 inches; internal width 1.50 inches; external depth 3.00 inches; internal depth 1.50 inches. The nest appears large for the size of the bird.

"No. 2. The nest of Asbury's finding in the water oak was cut down today and though it was probably completed by the 9th, not an egg was yet laid. Supposing it was completed on or before the 9th at least ten or eleven days

have elapsed since it was finished. As a rule not less than eighteen days should be allowed from the time the nest is done till it is taken.

"April 18, 1893. No. 4. The nest in the pine tree proved to have a set of five eggs slightly incubated. It was built on a pine limb, and so concealed as to be found only by seeing the old bird take the nest. This was twenty-five feet from the ground and seven and a half feet from the axis of the tree.

"External width of nest 2.90 inches; internal width 1.65 inches; external depth 3.00 inches; internal depth 1.70 inches. Material: strips of bark and straw on the outside, attached to the limb of the pine by a substance resembling spider web and giving the nest a grayish appearance externally; inside of nest lined with hairs, apparently of the cow, and with feathers.

"April 20, 1893. No. 5. A yellow-throated warbler was discovered building her nest this afternoon in a sweet gum. The nest is completely concealed in a bunch of moss and is at least fifty-five or sixty feet from the ground, and on the end of a limb. The male and female were observed feeding together; they visited several bunches of moss; at last they both flew high up to a moss covered branch and disappeared in the moss; the male then left his companion, and she was observed many times to dart to the earth and return to the bunch of moss. It was evident after she had many times flown to and from the moss that she was building.

"April 24, 1893. No. 3. No. three's nest (*D. dominica*) was taken this afternoon. It contained four slightly incubated eggs. Nest was on the horizontal limb of a sweet gum, 26 ft. from the ground and 9 ft. from the body of the tree.

"The parent remained on the nest till she was shaken from it by the jarring of a pole on the limb. This nest was found on the evening of the 10th; it was taken on the 24th, just fourteen days from the time it was first discovered. The bird was last seen building on the 12th; she was then lining the nest, as I saw her carrying a large feather in her bill.

"April 25, 1893. No. 5 was seen building to-day, the fifth day since she was discovered carrying material for a nest.

"April 27, 1893. No. 6 (*D. dominica*). Another nest of the yellow-throated warbler was found this morning. She was seen entering a bunch of moss, and the nest was thus located. Pellets of silk of cocoons and the web or tents of certain larvæ were gathered; the bird returning every five or ten minutes with a wad of something white in her mouth. She was found gathering this white substance from under the bark of pine trees. She pecked from a small hole in the side of a pine as much of this white substance as she could hold in her bill at one time, and made a second visit to the same spot from which she extracted as much building material a second time. She was constructing her nest in the morning at 9 o'clock, and on returning four hours after I found her still busily employed.

"No. 7. At Millwood a nest of *D. dominica* was found on May 6th. The nest was on a limb ninety feet from the ground, and three feet from the axis of the tree. Three pairs of yellow-throated warblers were seen, and a young one just out of the nest.

"May 8, 1893 Nest No. 5 was examined today by Asbury and found empty, although eighteen days had elapsed since the bird was seen building. This was in a bunch of *Tillandsia* about fifty feet from the ground, and four feet from the trunk of the tree.

"May 8, 1893. No. 6 was also examined by Asbury and found to have the old bird apparently sitting. This nest was building on the 27th; only eleven days have passed since *D. dominica* No. 6 was found.

"May 10, 1893. No. 6 was taken this morning; bird seen building on the 27th of April; set complete. Bird was allowed in this case thirteen days to build nest and lay her set of eggs. This nest was concealed in bunch of *Tillandsia usneoides*, thirty-five feet from the ground and eleven feet from trunk of tree. The nest was supported not only by the gray moss but also by the end of the limb upon which grew the moss. It was very neatly and compactly built.

"May 14, 1893. Took nest No. 5 this morning; it contained bits of egg shells. The nest was found building on the 20th of April and examined on the 8th of May—eighteen days from the first day the bird was seen building. The eggs must have been destroyed by a jay or in some unaccountable way, for they could hardly have hatched and the young have left the nest in less than three weeks.

No. 142. Female. Greensboro. May 20, 1889. W. C. Avery.
No. 430. Male. Greensboro. Mar. 26, 1890. W. C. Avery.
No. 870. Sex (?). Anniston. June 28, 1891. W. C. Avery.
No. 1059. Female. Greensboro. May 6, 1893. W. C. Avery.
No. 1062. Male. Greensboro. Sept. 4, 1893. W. C. Avery.

178. DENDROICA VIRENS (Gmelin).
BLACK-THROATED GREEN WARBLER.

"Not common. Spring and autumn migrant. Arrives later than any warbler, except the myrtle and palm warblers in the fall. First seen this fall, October 16, last met with October 24. On October 23, a cold day, I observed, in the town of Greensboro, four of these warblers busily searching the leaves of a shade tree for insects. They were so gentle that one might stand with his face within two or three feet of them, as they hopped about on the lowest branches of the tree just over the edge of the sidewalk." (1891c).

No. 497. Male. Greensboro. May 4, 1890. W. C. Avery.
No. 498. (?) Female. Greensboro. May 4, 1890. W. C. Avery.
No. 499. Female. Greensboro. May 4, 1890. W. C. Avery.
No. 1072. Sex (?). Greensboro. Sept. 27, 1893. W. C. Avery.
No. 1078. Female. Greensboro. Oct. 8, 1893. W. C. Avery.
No. 1083 (?). Male. Greensboro. Oct. 10, 1893. W. C. Avery.
No. 1084. Male. Greensboro. Oct. 10, 1893. W. C. Avery.
No. 1085. Female. Greensboro. Oct. 10, 1893. W. C. Avery.
No. 1093. Female. Greensboro. Oct. 18, 1893. W. C. Avery.

179. DENDROICA VIGORSI (Audubon).
PINE WARBLER.

"Abundant. Resident. Breeds." (1891c).

The first recorded capture of this bird was on Jan. 10, 1878, when specimen No. 39 (old series) was collected at Greensboro. Mar. 18, 1888, Dr. Avery "found for the first time nest of *D. pinus*, on a horizontal limb of a

pine about fifteen feet from the ground; saw female pine creeper fly into the tree with material for her nest."

April 1, 1888, a set of three eggs was collected, near Greensboro, from a nest on a horizontal limb of a pine, twenty feet from the ground.

April 29, 1891, the Doctor observed a pine warbler feeding its young.

The following nesting notes are taken from the Doctor's original journal:

"March 24, 1893. Took a nest of a pine warbler, on the horizontal branch of a pine tree (*pinus mitis*) at 9 feet 10 inches from the axis of the tree, and 13 feet 4½ inches from the ground. The bird was discovered building her nest on the 9th of March. It was completed about the 12th. The last egg was laid on the 24th. The nest was attached to and in the fork of a horizontal branch. It was built of pine needles and strips of bark, and lined with feathers and hair. This bird had built her nest by the 12th; she was seen building it for three or four days. She began nidification on the 8th (or about that time) and the nest was finished in about four days.

"To-day, the 4th of April (1893), while making observations on the yellow-throated warbler whose nest was found on the 2nd, and also preparing to have Asbury climb a pine to take a nest of *D. pinus*, both parents appeared on the scene; one, the male I believe, with a worm, which he could be seen distinctly serving to his nestlings. It seems to me that this nest must have been built the first week in March for the young to have been hatched as early as the fourth of April. Of course operations for taking the nest were suspended; ladder and rope and saw were carried home. This nest of '*pinus*' is thirty feet from the ground and fifteen feet from the body of the tree, on a horizontal branch. The sites of the other two pine warblers' nests found this season are similar to that of the one just described. They are, judging from the eye, respectively fifteen and twenty-five feet from the ground."

Pine warblers were recorded as common near Perdido, Sept. 26, 1892.

No. 8. Male. Greensboro. Sept. 8, 1886. W. C. Avery.
No. 293. Male. Greensboro. Dec. 9, 1886. W. C. Avery.
No. ..... Male im. Greensboro. Nov. 29, 1889. W. C. Avery.
No. 329. Male. Greensboro. Dec. 23, 1889. W. C. Avery.
No. 733. (?). Male. Greensboro. Mar. 25, 1890. W. C. Avery.
No. 588. Male. Greensboro. Aug. 19, 1890. W. C. Avery.
No. 784. Male. Greensboro. Oct. 23, 1890. W. C. Avery.
No. 802. Male. Greensboro. Nov. 1, 1890. W. C. Avery.
No. 983 (?). Female. Greensboro. Aug. 17, 1890. W. C. Avery.
No. 787 (?). Male. Greensboro. Oct. 2, 1893. W. C. Avery.

180. DENDROICA PALMARUM PALMARUM (Gmelin).
PALM WARBLER.

"Common. Spring migrant. A few have been observed in the fall of previous years; none seen this fall. First met with last year in the spring migration, on April 6, last on May 6." (1891c).

April 23, 1887, recording two specimens of this warbler, Dr. Avery writes: "First of the species I have ever collected. Shot three in Millwood swamp on edge of pond. The first one shot—by a singular coincidence—fell within an inch of a large moccasin, which might have *collected* me had I not seen him sooner. As it was I collected him and the bird also."

No. 448. Male. Greensboro. Apr. 12, 1890. W. C. Avery.
No. 463. Male. Greensboro. Apr. 18, 1890. W. C. Avery.
No. 468. Female. Greensboro. Apr. 21, 1890. W. C. Avery.
No. 469. Male. Greensboro. Apr. 21, 1890. W. C. Avery.
No. 470. Female. Greensboro. Apr. 21, 1890. W. C. Avery.
No. 484. Female. Greensboro. Apr. 27, 1890. W. C. Avery.
No. 485. Female. Greensboro. Apr. 27, 1890. W. C. Avery.
No. 486. Female. Greensboro. Apr. 28, 1890. W. C. Avery.
No. 487. Female. Greensboro. Apr. 28, 1890. W. C. Avery.
No. 493. Female. Greensboro. Apr. 30, 1890. W. C. Avery.
No. 494. Female. Greensboro. Apr. 30, 1890. W. C. Avery.
No. 495. Female. Greensboro. Apr. 30, 1890. W. C. Avery.
No. 503. Female. Greensboro. May 6, 1890. W. C. Avery.
No. 1062. Male. Greensboro. Sept. 15, 1893. W. C. Avery.
No. 1095. Female. Greensboro. Oct. 25, 1893. W. C. Avery.

181. DENDROICA PALMARUM HYPOCHRYSEA (Ridgway).
YELLOW PALM WARBLER.

"Only one specimen of this form has come under my observation, and that occurred April 21 last; the usual form here is typical *palmarum*, or a form intermediate between this one and *Dendroica palmarum*." (1891c).

All three of the specimens taken on April 21, 1890, are referable to subspecies *palmarum*, but it is quite probable that both forms occur during migrations in Hale County.

182. DENDROICA DISCOLOR (Vieillot).
PRAIRIE WARBLER.

"Common. Summer resident. Breeds." (1891c).

May 1, 1889, Dr. Avery shot an incubating female to properly identify a nest with eggs. A month later he writes: "Found five nests of the prairie warbler on the 1st of June; all empty but one which had two eggs in it. These nests were all in young sweet gums and from about two or three to six feet from the ground."

No. 444. Male. Greensboro. April 6, 1890. W. C. Avery.
No. 450. Male. Greensboro. April 12, 1890. W. C. Avery.
No. 464. Sex (?). Greensboro. Apr. 18, 1890. W. C. Avery.
No. 598. Male. Greensboro. Aug. 22, 1890. W. C. Avery.
No. 615. Female. Greensboro. Aug. 25, 1890. W. C. Avery.
No. 888. Male. Greensboro. Aug. 11, 1891. W. C. Avery.
No. 894. Male. Greensboro. Aug. 15, 1891. W. C. Avery.

183. SEIURUS AUROCAPILLUS (Linnæus).
OVEN-BIRD.

"Met with during autumn migration. Not common." (1891c).

"The 11th of October (1890) was the first day that I had met with the oven-bird (*S. aurocapillus*) with the exception of two specimens previously collected by me. This bird has the same mode of locomotion as the titlarks: *walking* instead of *hopping*. It was curious to see it progressing as it did—lighting on the ground and running off like a partridge. The oven-birds were met with on the live oak ridge running east to the Cypress Slough." (Original notes).

No. 43. No data.
No. 338. No data.
No. 589. Female. Greensboro. Aug. 21, 1890. W. C. Avery.
No. 672. Female. Greensboro. Sept. 16, 1890. W. C. Avery.
No. 744. Female. Greensboro. Oct. 11, 1890. W. C. Avery.
No. 745. Female. Greensboro. Oct. 11, 1890. W. C. Avery.
No. 746. Male. Greensboro. Oct. 11, 1890. W. C. Avery.
No. 763. Male. Greensboro. Oct. 18, 1890. W. C. Avery.
No. 770. Male. Greensboro. Oct. 19, 1890. W. C. Avery.

184. SEIURUS NOVEBORACENSIS NOVEBORACENSIS (Gmelin).
WATER-THRUSH.

"Observed in autumn migration. Rare." (1891c).

No. 688. Male. Greensboro. Sept. 19, 1890. W. C. Avery.

185. SEIURUS NOVEBORACENSIS NOTABILIS (Ridgway).
GRINNELL'S WATER-THRUSH.

The two Hale County specimens listed below are referable to this form.

No. 991. Male. Greensboro. Sept. 3, 1892. W. C. Avery.
No. 1061. Female. Greensboro. Aug. 25, 1893. W. C. Avery.

186. SEIURUS MOTACILLA (Vieillot).
LOUISIANA WATER-THRUSH.

"Rare. A specimen in my collection was taken on June 30; another captured in April gave evidence that the bird was breeding. That taken in June being well within the breeding season, cannot be considered a migrant, while the functional activity of the ovary of the latter example proved that it was a breeding female." (1891c).

No. 44 (?). Female. Greensboro. No other data.

187. OPORORNIS FORMOSUS (Wilson).
KENTUCKY WARBLER.

"Common. Summer resident. Breeds." (1891c).

"April 10, 1893. The Kentucky warbler was heard singing yesterday and again today. His monotonous 'Tweedle! Tweedle! Tweedle!' proclaim his arrival and also his intention of rearing a family at some early period. This warbler is common in Hale County but his retired habits make it not an easy task to study his manner of nidification. He is very shy, affecting the dense cover and undergrowth bordering some stream of water, and rarely leaving the ground to fly into the trees 'till he is either seeking a mate or wishes to exhibit to his admiring companion that he is what his name indicates: Formosa or beautiful. Then his 'Tweedle! Tweedle! Tweedle!' resounds overhead, as he flies from tree to tree. He returns from winter quarters about the first week in April

and departs for the tropics, I believe, before the first of October.

"On June 4th, 1889, I took a nest of *formosa* on a shady, steep hillside, at the foot of a small sassafras (*S. officinale*). The set contained four eggs; incubation slight.

"My latest record of *G. formosa* is September the 12th; my observations lead me to believe that it does not tarry long after this date." (Original notes).

No. 547. Female-hornot. Greensboro. July 21, 1890. W. C. Avery.
No. 613. Male. Greensboro. Aug. 25, 1890. W. C. Avery.

188. GEOTHLYPIS TRICHAS IGNOTA (Chapman). FLORIDA YELLOW-THROAT.

The first mention of this species is the record of a male taken June 17, 1876, at Greensboro, whose "stomach contained debris of insects." The following was appended: "This little bird seems to abound in the thickets about marshes and streams. Its song is so similar to that of the house wren (*Troglodytes aedon,* the singing troglodyte) that it requires a practised ear to distinguish between them." Another bit of evidence that the Doctor was young at the work in '76.

A couple of early records are Feb. 15, 1887, when the Doctor heard the notes of a yellow-throat, and Mar. 20th, when an adult male was seen. A female was taken on Mar. 11, 1890.

May 24, 1888, a set of three eggs was collected near Greensboro. "Incubation of three or four days. Nest was concealed on a blackberry vine, and supported about three or four inches from the ground, in thick briers and weeds."

In April, 1891, the Doctor writes in his journal: "Nest of *Geothlypis trichas* was found on the 23rd; it contained only one egg; an egg was laid every day till the set (four) was produced. Nest on the ground near a bunch of broom grass (*Andropogon virginica*)."

"Common. Summer resident. Breeds." (1891c).

No. 406. Female. Greensboro. Mar. 11, 1890. W. C. Avery.
No. 657. Male. Greensboro. Sept. 6, 1890. W. C. Avery.

No. 921. Male im. Greensboro. Sept. 10, 1891. W. C. Avery.
No. 1043. Male. Greensboro. Apr. 15, 1893. W. C. Avery.

189. ICTERIA VIRENS VIRENS (Linnæus).
YELLOW-BREASTED CHAT.

No. 3 (old series) of Dr. Avery's collection was an adult male of this species taken May 27, 1876, near Contentment, 1½ miles southwest of Greensboro. The stomach contained blackberry seed and debris of insects. After recording the specimen he writes: "This bird is a summer visitant, appearing in April and disappearing with cool weather in the fall.

"He is a noisy bird; generally found in cool, low, marshy places, where sometimes leaving his dark haunts, he perches upon a tall tree and utters a succession of strange notes such as 'baw-tate-tate-tate-chuck' and then a whistle. These are but a few of the strange sounds with which he enlivens his shady haunts.

"He doubtless breeds here, though I have never seen his nest nor found his young."

Writing in 1888, the Doctor says: "I was waked from profound sleep by the fluttering of a bird in my room on the morning of April 21 at three o'clock. I lighted my lamp and caught the bewildered bird, No. 55 of my collection." The stomach of this specimen contained insects.

May 21, 1888, a set of four eggs was taken near Greensboro. "Incubation advanced. Nest in plum tree (*Prunus chicasa Michx.*), two feet from the ground. Measurements of eggs: No. 1, .85 by .67; No. 2, .81 by .66; No. 3, .82 by .65; No. 4, .80 by .67; average .82 by .67. Sent to Capt. Charles Bendire."

"Common. Summer resident. Breeds." (1891c).

The chat was taken by Dr. Avery near the mouth of Perdido Bay on his visit to Baldwin County, Sept. 16th to October 2nd, 1892.

No. 55. Male. Greensboro. Apr. 21. 1888. W. C. Avery.
No. 602. Male. Greensboro. Aug. 23, 1890. W. C. Avery.
No. 1039. Male. Greensboro. Apr. 8, 1893. W. C. Avery.

190. WILSONIA CITRINA (Boddaert).
HOODED WARBLER.

"Common. Observed during spring and autumn migration. One specimen was taken on June 30 at Millwood, on the Warrior River. It may be inferred from this fact that this warbler breeds in Hale County." (1891c).

One specimen of this species was taken on September 17th, 1892, on Bear Point, Baldwin County.

No. 557. Female. Greensboro. Aug. 11, 1890. W. C. Avery.
No. 563. Male. Greensboro. Aug. 12, 1890. W. C. Avery.
No. 624. Male. Greensboro. Aug. 30, 1890. W. C. Avery.
No. 626. Female. Greensboro. Aug. 30, 1890. W. C. Avery.
No. 627. Female. Greensboro. Aug. 30, 1890. W. C. Avery.
No. 902. Male. Greensboro. Aug. 25, 1891. W. C. Avery.
No. 1000 (?). Male. Greensboro. May 6, 1893. W. C. Avery.
No. 1041. Female. Greensboro. Apr. 15, 1893. W. C. Avery.
No. 1074. Male. Greensboro. Sept. 30, 1893. W. C. Avery.

191. WILSONIA CANADENSIS. (Linnæus).
CANADA WARBLER.

"One specimen only taken on August 29 last." (1891c).

No. 618. Male. Greensboro. Aug. 29, 1890. W. C. Avery.

192. SETOPHAGA RUTICILLA (Linnæus).
REDSTART.

"Abundant in the river bottom. Summer resident. Breeds. (1891c))

No. 683. Male. Greensboro. Sept. 17, 1890. W. C. Avery.
No. 708. Female. Greensboro. Sept. 26, 1890. W. C. Avery.
No. 737. Male. Greensboro. Oct. 7, 1890. W. C. Avery.

193. ANTHUS RUBESCENS (Tunstall).
PIPIT.

"Common. Winter resident." (1891c).

No. 341. Male. Greensboro. Jan. 4, 1890. W. C. Avery.

194. MIMUS POLYGLOTTOS POLYGLOTTOS (Linnæus).
MOCKINGBIRD.

"Abundant. Resident. Breeds. Much has been said about the difference in excellence of the song of this bird. The mature old males sing best; while it requires perhaps two or three seasons for the younger males to attain the full development of their vocal powers.

One has but to hear the feeble efforts at song of the young males of the first season to perceive the difference. Several years ago there was an adult male, however, that made the most discordant sounds; his song, if that can be called song, which was a repetition for hours at a time of the same monotonous noise, such as 'chay! chay! chay! chay!' prolonged indefinitely in the same key, was the only music he ever produced. I often asked myself: 'Is that bird an idiot, or is his musical apparatus defective'?" (1891c).

A set of four eggs of the mocking-bird was taken from a hawthorn, about three feet from the ground, near Greensboro, April 25, 1888. The eggs measured: .91 by .72, .89 by .71, .94 by .70, and .95 by .71.

Young mockingbirds one-third grown were recorded on the 28th of April, 1891, in the Doctor's journal.

Among the Doctor's Baldwin County notes, Sept. 16th to Oct. 2nd, 1892, is the following: "Mockingbirds were abundant; there were many seen; near Pensacola, in fact in the incorporated limits of the town, hundreds were seen feeding on pokeberries."

It is an interesting fact that the label of the unnumbered specimen cited below bears this note: "Collected by *C. hudsonius*."

No. ..... Male. juv. Greensboro. Sept. 17, 1889. W. C. Avery.
No. 315. Male. Greensboro. Dec. 13, 1889. W. C. Avery.
No. 320. Male. Greensboro. Dec. 20, 1889. W. C. Avery.
No. 528. Female. Greensboro. June 2, 1890. W. C. Avery.
No. 1086. Male. Greensboro. Oct. 10, 1893. W. C. Avery.
No. 1110. Female. Greensboro. Dec. 30, 1893. W. C. Avery.
No. 1111. Male. Greensboro. Mar. 5, 1894. W. C. Avery.

The last named specimen was the last bird collected by Dr. Avery. It is significant of his activity as an ornithologist that this specimen was taken just six days before his death.

195. DUMETELLA CAROLINENSIS (Linnæus).
CATBIRD.

This species is entirely omitted from Dr. Avery's list, "Birds Observed in Alabama," though a number of specimens fell to his gun. Besides his Hale County records,

he noted that catbirds were abundant in Baldwin County, Sept. 16th to Oct. 2, 1892.

No. 21. Male. Greensboro. May 18, 1887. W. C. Avery.
No. 283. No data.
No. 294. No data.
No. 664. Male. Greensboro. Sept. 9, 1890. W. C. Avery.
No. 1075. Female. Greensboro. Oct. 3, 1893. W. C. Avery.

196. TOXOSTOMA RUFUM (Linnæus).
BROWN THRASHER.

"Common. Resident. Breeds." (1891c).

The Baldwin County notes for Sept. 16th to Oct. 2, 1892, include the following: "Brown thrashers were seen near the lagoon on the Gulf Coast on Sept. 26th."

No. 525. Male. Greensboro. May 31, 1890. W. C. Avery.
No. 553. Male-hornot. Greensboro. July 28, 1890. W. C. Avery.
No. 673. Female. Greensboro. Sept. 16, 1890. W. C. Avery.
No. 833. Male. Greensboro. May 4, 1891. W. C. Avery.
No. 1100. Male. Greensboro. Oct. 26, 1893. W. C. Avery.
No. 1101. Male. Greensboro. Oct. 26, 1893. W. C. Avery.

197. THRYOTHORUS LUDOVICIANUS LUDOVICIANUS (Latham).
CAROLINA WREN.

"Abundant. Resident. Breeds." (1891c).

Under date of June 3, 1876, Dr. Avery enters specimen No. 5, an adult male of this species, in his journal, and writes:

"A common bird in Alabama, where he is found during the whole year. His song is not varied, but loud and musical. When a rain has refreshed the parched earth, and the sunshine plays upon the green trees and herbage, his song may often be heard, as if he too rejoiced with all nature."

The stomach of a specimen taken June 1, 1889, contained a "chinch bug and other insects."

The Carolina wren was recorded as common in Baldwin County, Sept. 16th to Oct. 2, 1892.

No. 158. Female. Greensboro. June 1, 1889. W. C. Avery.
No. 286. Female. Greensboro. Nov. 25, 1889. W. C. Avery.
No. 322. Male. Greensboro. Dec. 20, 1889. W. C. Avery.
No. 757. Male. Greensboro. Oct. 16, 1890. W. C. Avery.

No. 883. Male. Anniston. July 8, 1891. W. C. Avery.
No. 884. Female. Anniston. July 8, 1891. W. C. Avery.

198. THRYOMANES BEWICKI BEWICKI (Audubon).
BEWICK'S WREN.

"Not common. Winter resident." (1891c).

The earliest fall arrival of the species recorded is Sept. 17, 1891.

No. 243. Male. Greensboro. Oct. 12, 1889. W. C. Avery.
No. 282. Female. Greensboro. Nov. 30, 1889. W. C. Avery.
No. 338. Male. Greensboro. Jan. 3, 1890. W. C. Avery.
No. 791. Female. Greensboro. Oct. 25, 1890. W. C. Avery.
No. 794. Male. Greensboro. Oct. 25, 1890. W. C. Avery.
No. 1068. Male. Greensboro. Sept. 21, 1893. W. C. Avery.
No. 1080. Male. Greensboro. Oct. 9, 1893. W. C. Avery.
No. 1081. Male. Greensboro. Oct. 9, 1893. W. C. Avery.
No. 1088. Female. Greensboro. Oct. 14, 1893. W. C. Avery.
No. 1091. Male. Greensboro. Oct. 16, 1893. W. C. Avery.
No. 1103. Female. Greensboro. Oct. 27, 1893. W. C. Avery.

199. TROGLODYTES ÆDON ÆDON (Vieillot).
HOUSE WREN.

Under date of Sept. 8, 1886, Dr. Avery records a house wren, but this record is rather doubtful because he omitted it from his "Birds Observed in Alabama." Again, April 6, 1893, he notes in his journal: "A very small wren was seen in a rose hedge. It was not the winter wren nor Carolina nor Bewicks' hence it must have been *Troglodytes aedon*." However, in 1893, a specimen was taken at Greensboro and is still in the collection.

No. 1022. Male. Greensboro. 1893. W. C. Avery.

200. CERTHIA FAMILIARIS AMERICANA (Bonaparte).
BROWN CREEPER.

"Not common. Winter resident." (1891c).

No. 308. Male. Greensboro. Dec. 11, 1889. W. C. Avery.
No. 343. Male. Greensboro. Jan. 4, 1890. W. C. Avery.
No. 775. Female. Greensboro. Oct. 21, 1890. W. C. Avery.

201. SITTA CAROLINENSIS ATKINSI (Scott).
FLORIDA WHITE-BREASTED NUTHATCH.

"Not common. Resident. Breeds." (1891c).

No. 418. Male. Greensboro. Mar. 15, 1890. W. C. Avery.
No. 890. Male. Greensboro. Aug. 11, 1890. W. C. Avery.

202. SITTA CANADENSIS (Linnæus).
RED-BREASTED NUTHATCH.

"Migrant. In my collection is one example taken October 4, 1888, the only one I have ever met with." (1891c).

The red-breasted nuthatch is not a regular migrant in Alabama, but should more properly be classed as a straggler.

No. 93. Male (adult) Greensboro. Oct. 4, 1888. W. C. Avery.

203. SITTA PUSILLA (Latham).
BROWN-HEADED NUTHATCH.

"Common. Resident. Breeds." (1891c).

May 1, 1888, a set of five eggs was taken two miles west of Greensboro. "Nest was in a post, about five feet from the ground. The parent when exposed by having the excavation, in which she was sitting, laid open to the bottom, did not move 'till the hand was extended to take her from the nest. The entrance to the nest was a circular hole about two inches in diameter; the cavity being about ten inches deep and three or four inches wide, the hole at the bottom being extended laterally and excavated so as to receive the nest. This was of cotton and hair, lined with the samaræ of maple or ash." Eggs measured: .59 by .45, .56 by .45, .56 x .44, .58 by .47, and .56 by .45.

May 2, 1888, a set of four eggs was taken near the same locality. Incubation just begun. "Nest was about four feet from the ground in a dead pine stump; bird sat on nest till I broke away outside shell and exposed her to view." Eggs measured: .62 by .48, .60 by .48, .65 by .47, and .63 by .47.

The Doctor records seeing brown-headed nuthatches in Baldwin County, Oct. 2, 1892.

No. 222. Male. Greensboro. Sept. 22, 1889. W. C. Avery.
No. 423. Male. Greensboro. Mar. 15, 1890. W. C. Avery.
No. 424. Female. Greensboro. Mar. 15, 1890. W. C. Avery.
No. 641. Female. Greensboro. Sept. 4, 1890. W. C. Avery.
No. 885. Male. Anniston. July 1, 1891. W. C. Avery.
No. 965. Male. Greensboro. Dec. 23, 1891. W. C. Avery.

204. BÆOLOPHUS BICOLOR (Linnæus).
TUFTED TITMOUSE.

"Common. Resident. Breeds." (1891c).

Several recorded in Baldwin County, Sept. 16th to Oct. 2, 1892.

No. 342. Female. Greensboro. Jan. 4, 1890. W. C. Avery.
No. 419. Male. Greensboro. Mar. 15, 1890. W. C. Avery.
No. 778. Male. Greensboro. Oct. 21, 1890. W. C. Avery.

205. PENTHESTES CAROLINENSIS CAROLINENSIS (Audubon).
CAROLINA CHICKADEE.

"Common. Resident. Breeds." (1891c).

Recorded in Baldwin County, Sept. 30, 1892.

No. 277. Female. Greensboro. Nov. 23, 1889. W. C. Avery.
No. 300. Female. Greensboro. Dec. 9, 1889. W. C. Avery.
No. 302. Male. Greensboro. Dec. 10, 1889. W. C. Avery.
No. 426. Male. Greensboro. Mar. 15, 1890. W. C. Avery.

206. REGULUS SATRAPA SATRAPA (Lichtenstein).
GOLDEN-CROWNED KINGLET.

"Common. Winter resident." (1891c).

No. 264. Male. Greensboro. Nov. 9, 1889. W. C. Avery.
No. 336. Female. Greensboro. Jan. 3, 1890. W. C. Avery.
No. 429. Sex (?). Mar. 20, 1890. W. C. Avery.
No. 799. Female. Greensboro. Oct. 27, 1890. W. C. Avery.
No. ..... Odd specimen—No data.
No. ..... Odd specimen—No data.

207. REGULUS CALENDULA CALENDULA (Linnæus).
RUBY-CROWNED KINGLET.

"Common. Winter resident." (1891c).

No. 816, cited below, was singing when shot. Unfortunately for Alabamians, however, the ruby-crown does not render its song in full volume while within the State. It is one of the most remarkable of North American songsters.

No. 104. Male. Greensboro. Apr. 6, 1889. W. C. Avery.
No. 105. Female. Greensboro. Apr. 6, 1889. W. C. Avery.
No. 249. Male. Greensboro. Oct. 26, 1889. W. C. Avery.
No. 771. Female. Greensboro. Oct. 19, 1890. W. C. Avery.
No. 816. Male. Greensboro. Mar. 22, 1891. W. C. Avery.

208. POLIOPTILA CÆRULEA CÆRULEA (Linnæus).
BLUE-GRAY GNATCATCHER.

"Abundant. Summer resident. Breeds." (1891c).

The gnatcatcher was first recorded under date of June 3, 1876, when an adult male was taken at Greensboro. Part of the entry follows: "This bird is found in warm weather. The nest, like that of the hummingbird, is beautifully constructed, woven around and to the sides of the branches so as to appear like an excrescence."

The following interesting record of the Doctor's early struggle with ornithology is taken from his "Oological Register" under date of May 14, 1876: "This nest (gnatcatcher) is that of the smallest bird in this country except the hummingbird. When I was a boy there was a smaller bird than the builder of nest No. 3. It has disappeared. It exists in this region, at least, no more. It was so small that the smallest sparrow compared to it was large. My recollection of it is that it had a small yellow spot upon the occiput and was of a leaden color on the belly, while the back was of a greenish tinge. It has been many years since I saw it, perhaps twenty-five. It hopped about upon the trees and especially upon the small pines, examining minutely every leaf for its food. It was so gentle that I remember once when a boy that for want of another missile that I took my cap from my head and struck one dead from a bush."

It is quite patent that the gentle bird was a golden-crowned kinglet, but it is surprising that one whose observational powers were so keen as to fix a fairly accurate description in his mind for twenty-five years should so long overlook a common winter visitant.

May 4, 1888, a set of five eggs was collected eight miles south of Greensboro. The nest was in a sweet gum, fifteen feet from the ground. Three of the eggs were broken; the remaining two measured: .56 by .49 and .58 by .48.

April 4, 1893, while making observations on the nesting of the yellow-throated warbler Dr. Avery discovered another nest of the gnatcatcher. He writes: "The wheezy,

squeaking calls of two blue-gray gnatcatchers were heard in the water oak, and one of the birds flew to the ground and gathered material for a nest from the side of a decayed stump within ten feet of where we sat. A few minutes' search was rewarded by the discovery of the nest upon the horizontal branch of an elm not more than a hundred feet from the water oak. The beautiful, lichen covered cup was glued to the surface of the branch so tightly that no wind could move it, frail though it was, from the spot where the skillful architect had placed it."

The species was recorded on Perdido Bay, Sept. 16th to Oct. 2, 1892.

No. 231. Male. Greensboro. Mar. 26, 1890. W. C. Avery.
No. 567. Male. Greensboro. Aug. 12, 1890. W. C. Avery.

209. HYLOCICHLA MUSTELINA (Gmelin).
WOOD THRUSH.
"Swamp Sparrow"

"Common. Summer resident. Breeds." (1891c).

June 26, 1875, Dr. Avery wrote in French in his journal: "I found today the nest of a bird which is called in English 'swamp sparrow.' In the morning they (the two birds) began the nest and finished it in the afternoon of the same day: I did not think that it was possible that a bird could construct its nest so soon." (The wood thrush is commonly known to the people of certain rural sections of Alabama as "swamp sparrow").

April 26, 1888, a set of four eggs was taken at Greensboro; incubation just begun. The nest was in the top of a small shell-bark hickory, about ten feet from the ground. The eggs measured: 1.05 by .76, 1.03 by .74, 1.01 by .72, and .97 by .71. This set was sent to Capt. Charles Bendire.

No. 44. Male. Greensboro. Apr. 4, 1888. W. C. Avery.
No. 542. Male. Greensboro. July 16, 1890. W. C. Avery.
No. 711. Female. Greensboro. Sept. 29, 1890. W. C. Avery.
No. 712. Male. Greensboro. Sept. 29, 1890. W. C. Avery.
No. 717. Female. Greensboro. Sept. 30, 1890. W. C. Avery.
No. 875. Male Anniston. July 3, 1891. W. C. Avery.
No. 937. Male. Greensboro. Sept. 25, 1891. W. C. Avery.

210. HYLOCICHLA FUSCESCENS FUSCESCENS (Stephens).
VEERY. WILSON'S THRUSH.

"My first record of this thrush for the autumn migration of last year is September 9, my last is September 25. Between these dates it was frequently seen, and though I was out, on an average, four days in the week till the first of November, no specimen was met with after September 25." (1891c).

A specimen was taken on Bear Point, Perdido Bay, Sept. 17, 1892.

No. 636. Female. Greensboro. Sept. 3, 1890. W. C. Avery.
No. 662. Male. Greensboro. Sept. 9, 1890. W. C. Avery.
No. 667. Male. Greensboro. Sept. 11, 1890. W. C. Avery.
No. 675. Male. Greensboro. Sept. 16, 1890. W. C. Avery.
No. 680 (?). Greensboro. Sept. 15, 1890. W. C. Avery.
No. 689. Male. Greensboro. Sept. 19, 1890. W. C. Avery.
No. 694. Female. Greensboro. Sept. 22, 1890. W. C. Avery.
No. 695. Male. Greensboro. Sept. 22, 1890. W. C. Avery.
No. 700. Male. Greensboro. Sept. 23, 1890. W. C. Avery.
No. 704. Female. Greensboro. Sept. 25, 1890. W. C. Avery.
No. 905. Male. Greensboro. Aug. 26, 1891. W. C. Avery.
No. 918. Male. Greensboro. Sept. 10, 1891. W. C. Avery.
No. 929. Female. Greensboro. Sept. 23, 1891. W. C. Avery.

211. HYLOCICHLA ALICIÆ ALICIÆ (Baird).
GRAY-CHEEKED THRUSH.

Apparently the Doctor did not distinguish this, the typical subspecies, from Bicknell's thrush for two of the three specimens mentioned under the latter form in his "Birds Observed in Alabama" are really referable to *aliciae*.

No. 703. Female. Greensboro. Sept. 25, 1890. W. C. Avery.
No. 724. Male. Greensboro. Oct. 2, 1890. W. C. Avery.
No. 725. Male. Greensboro. Oct. 2, 1890. W. C. Avery.
No. 739. Female. Greensboro. Oct. 7, 1890. W. C. Avery.
No. 762. Female. Greensboro. Oct. 17, 1890. W.C. Avery.
No. 772. Male. Greensboro. Oct. 20, 1890. W. C. Avery.
No. 916. Male. Greensboro. Sept. 10, 1891. W. C. Avery.
No. 930. Female. Greensboro. Sept. 23, 1891. W. C. Avery.
No. 931. Male. Greensboro. Sept. 23, 1891. W. C. Avery.
No. 939. Female. Greensboro. Sept. 26, 1891. W. C. Avery.

212. HYLOCICHLA ALICIÆ BICKNELLI (Ridgway).
BICKNELL'S THRUSH.

"One was taken on September 17. The next record is September 25, the last October 20. These thrushes were

frequently seen from the first to the twentieth of October, the date of my last record." (1891c).

No. 687. Male. Greensboro. Sept. 17, 1890. W. C. Avery.
No. 719. Female. Greensboro. Oct. 1, 1890. W. C. Avery.
No. 928. Female. Greensboro. Sept. 19, 1891. W. C. Avery.
No. 936. Female. Greensboro. Sept. 25, 1891. W. C. Avery.
No. 1067. Female. Greensboro. Sept. 20, 1893. W. C. Avery.

213. HYLOCICHLA USTULATA SWAINSONI (Tschudi).
OLIVE-BACKED THRUSH.

"Was observed from the twentieth of September till the first week in October. This species with the two preceding fed mostly upon the berries of the Black Gum (*Nyssa multiflora*); and could be seen at all times of the day flying to and from these trees. The specimens obtained were so fat that it was with difficulty that a good skin could be made from them. How these birds could migrate for a thousand miles perhaps, and cross the sea, as some of them do, carrying so much dead weight, is difficult to imagine. And yet they do fly without trouble. It may be that this extra adipose material is a supply stored up for their journey, without which they might not accomplish it." (1891c).

No. 223. Sex (?). Greensboro. Sept. 27, 1889. W. C. Avery.
No. 686. Male. Greensboro. Sept. 17, 1890. W. C. Avery.
No. 714. Female. Greensboro. Sept. 30, 1890. W. C. Avery.
No. 716. Male. Greensboro. Sept. 30, 1890. W. C. Avery.
No. 720. Male. Greensboro. Oct. 1, 1890. W. C. Avery.
No. 721. Male. Greensboro. Oct. 1, 1890. W. C. Avery.
No. 726. Female. Greensboro. Oct. 2, 1890. W. C. Avery.
No. 750. Male. Greensboro. Oct. 13, 1890. W. C. Avery.
No. 935. Female. Greensboro. Sept. 25, 1891. W. C. Avery.
No. 938. Female. Greensboro. Sept. 26, 1891. W. C. Avery.
No. 1056. Male. Greensboro. May 3, 1893. W. C. Avery.

214. HYLOCICHLA GUTTATA PALLASI (Cabanis).
HERMIT THRUSH.

"Not common. Winter resident. First arrival recorded this fall is on October 24." (1891c).

The stomachs of three specimens, taken Jan. 22, 1878, April 4, 1888, and April 5, 1888, respectively, contained beetles.

No. 233. No data.
No. 273. Female. Greensboro. Nov. 14, 1889. W. C. Avery.

No. 325. Male. Greensboro. Dec. 21, 1889. W. C. Avery.
No. 356. Male. Greensboro. Jan. 25, 1890. W. C. Avery.
No. 789. Male. Greensboro. Oct. 24, 1890. W. C. Avery.
No. 796. Male. Greensboro. Oct. 25, 1890. W. C. Avery.
No. 804. Male. Greensboro. Nov. 5, 1890. W. C. Avery.

215. PLANESTICUS MIGRATORIUS ACHRUSTERUS (Batchelder).
SOUTHERN ROBIN.

"Common. Winter resident. First appeared in this locality this fall, on October 19. Two pairs of robins nested the past season in the yard of John L. Cobbs, state treasurer, in the city of Montgomery. The young were reared, and they remained with their parents in the yard of Mr. Cobbs all the summer and were still there in October, as was reported to me on inquiring. This is the first instance known to me of the robins nesting so far south. If these birds are not shot this winter, they may remain to breed again next year; and we may have the interesting spectacle of a colony of robins in a southern city." (1891c). This colony did not materialize, however, and the record remains unique.

No. 408. Male. Greensboro. Mar. 11, 1890. W. C. Avery.
No. 412. Female. Greensboro. Mar. 13, 1890. W. A. Cobbs.
No. 787. Male. Greensboro. Oct. 23, 1890. W. C. Avery.
No. 815. Female. Greensboro. Mar. 20, 1891. W. C. Avery.

216. SIALIA SIALIS SIALIS (Linnæus).
BLUEBIRD.

"Common. Resident. Breeds." (1891c).
Recorded in pine woods on Perdido Bay, Sept. 26, 1892.

No. 244. Male. Greensboro. Oct. 12, 1889. W. C. Avery.
No. 357. Male. Greensboro. Jan. 25, 1890. W. C. Avery.
No. 409. Male. Greensboro. Mar. 11, 1890. W. C. Avery.
No. 461. Female. Greensboro. Apr. 14, 1890. W. C. Avery.
No. 722. Male. Greensboro. Oct. 1, 1890. W. C. Avery.

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<American Field, Vol. XXI, No. 23, June 7, p. 545.

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<Ornithologist and Oologist, Vol. XI, No. 7, July, p. 107.

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<Orn. and Ool., Vol. XIV, No. 8, August, p. 122.

b. Chondestes grammacus.
<Am. Field, Vol. XXXII, No. 9, August 31, p. 200.

c. Notes. (Records instance of male Bob White incubating at Greensboro, Ala.)
<Am. Field, Vol. XXXII, No. 10, Sept. 7, p. 223.

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b. Swainson's Warbler in Hale County, Alabama.
<Orn. and Ool., Vol. XV, No. 10, October, p. 157.

c. Number of Eggs in a Set of the Cardinal.
<Orn. and Ool., Vol. XV, No. 12, December, p. 185.
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d. No. 1<Am. Field, Vol. XXXIV, No. 25, Dec. 20, p. 584.

e. No. 2.<Am. Field, Vol. XXXIV, No. 26, Dec. 27, p. 607.

1891a. No. 3.<Am. Field, Vol. XXXV, No. 1, Jan. 3, p. 8.

b. No. 4.<Am. Field, Vol. XXXV, No. 2, Jan. 10, p. 32.

c. No. 5.<Am. Field, Vol. XXXV, No. 3, Jan. 17, p. 55.

1893a. Natural History (Records of *Pelecanus erythrorhynchos* at Livingston and *Pelecanus occidentalis* near Fort Morgan, Ala.)
<Am. Field, Vol. XL, No. 1, July 1, p. 7.

b. (Rapidity of flight of the Duck Hawk).
<Orn. and Ool., Vol. XVIII, No. 10, October, p. 144.

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GEOLOGICAL SURVEY OF ALABAMA
EUGENE ALLEN SMITH, *State Geologist*

MUSEUM PAPER NO. 5
ALABAMA MUSEUM OF NATURAL HISTORY

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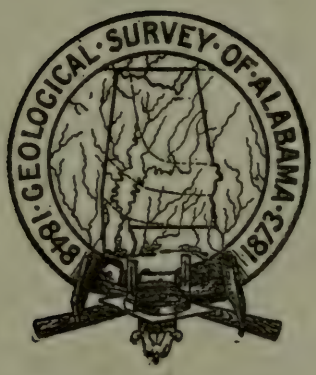
By
H. P. LÖDING



UNIVERSITY, ALABAMA
SEPTEMBER, 1922

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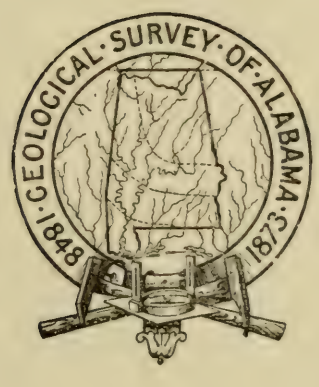

UNIVERSITY, ALABAMA

SEPTEMBER, 1922

PRESS
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LETTER OF TRANSMITTAL

University, Ala., June, 1922.

To His Execellency,
Governor Thomas E. Kilby,
Montgomery, Alabama.

Sir: I have the honor to transmit herewith the manuscript of a preliminary catalogue of the Amphibians and Reptiles of Alabama, by H. P. Loding, with the request that it be printed as Museum Paper No. 5 of the Alabama Museum of Natural History, (Geological Survey Museum.)

This catalogue has been prepared in pursuance of the policy of the Survey outlined in 1873, which contemplated the investigation not only of the geological and agricultural relations of the state, but of the fauna and flora also, since these have a most direct and important bearing on agriculture.

The author is a florist in Mobile, who has been for many years an enthusiastic student and collector of reptiles and other animal forms, including especially insects. He has prepared this report without cost to the Survey, for which our sincere thanks are due and herewith tendered.

In the closing chapter of this report "On the Collection and Preservation of Reptiles and Amphibians for Scientific and Museum Purposes", Mr. Loding points out the fact that these animals, so far from being a menace to the human family, are of equal importance with birds in the task of keeping destructive insects and rodents within bounds. If the present paper should help to educate our young people to an understanding of the economic value of these generally despised and hated forms, its publication will be amply justified.

Very respectfully,

EUGENE A. SMITH,
State Geologist.

GEOLOGICAL CORPS

Eugene Allen Smith, Ph. D.	State Geologist
William F. Prouty, Ph. D.	Assistant Geologists on Special Work
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RIVER GAGE HEIGHT OBSERVERS

Tallapoosa River at Sturdevant, Ala.

A. L. Stow ..... Alexander City, Ala.

Elk River, at Elkmont, Ala.

Dr. William E. Maples ..... Elkmont, Ala.

Observations are made every day by these observers of the gage readings at the several stations. From these records when extended through sufficient time, the calculation of available horse power to be obtained from the different streams is made.

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A PRELIMINARY CATALOGUE OF ALABAMA AMPHIBIANS AND REPTILES

By H. P. Löding

INTRODUCTION.

IN SUBMITTING for publication the following report on Amphibians and Reptiles found within the limits of the State, a few words of acknowledgement and explanation are necessary.

At the suggestion of Dr. Eugene A. Smith, State Geologist, it was originally agreed, that Mr. Julius Hurter, of St. Louis, Missouri, in conjunction with the writer, were to furnish material for a descriptive catalogue of Alabama amphibians and reptiles to be published by the Geological Survey of Alabama.

The death of Mr. Hurter in December, 1916, and the incomplete exploration of the State as a whole, have prevented the realization of this plan, at least for some time to come, and, in the meantime, it was deemed advisable to publish the data and records at hand, so as to stimulate and facilitate further studies and collections in the State, also in the hope, that the present list, however incomplete, may be of some use in throwing additional light upon the distribution of the species within the United States.

The list as here published is based upon collections made for a number of years in Mobile and Baldwin counties and on a short trip to northeast Alabama in June, 1911, by Mr. T. S. van Aller and the writer; upon specimens represented in the Alabama Museum of Natural History at the University of Alabama, the majority of which were collected by Mr. Herbert H. Smith and identified by Mr. Hurter during a visit to Alabama in the summer of 1915, or by Dr. Frank N. Blanchard and Mr. E. R. Dunn; and upon specimens in the Museum of Archives and History in Montgomery, Alabama, which were submitted for study through the courtesy of Dr. Thomas M. Owen, Director.

In the compilation of this list, the author is greatly indebted to the following for help and favors freely given:

To my dear departed friend, Mr. Julius Hurter of St. Louis, Missouri; Dr. Frank N. Blanchard of the University of Michigan; Mr. E. R. Dunn, Museum of Comparative Zoology, Harvard University; Dr. Eugene A. Smith of the University of Alabama;Mr. Herbert H. Smith, late Curator of the Alabama Museum of Natural History, University, Alabama; Mrs. H. H. Smith, acting curator of the museum; Dr. Thomas M. Owen, late Director of the State Department of Archives and History, and last but not least, to my best friend and companion, on all collecting trips for many years, Mr. Thomas S. van Aller of Mobile.

The interest taken by the following gentlemen in collecting and donating specimens also deserves being put on record: the late Mr. L. H. McNeill, Mr. W. C. Dukes, Dr. Toulmin Gaines, Mr. Thomas McMickle, Dr. Robert Peters, Mr. J. A. Joullian, all members or former members of the Charles Mohr Society of Natural History of Mobile. Mr. W. R. Jones of Satsuma; Messrs. P. A. Brannon, Adolph Dreyspring, Mac.Billings and Reese Martin of Montgomery, Mr. Lucien Lewis of Seale, and Charles Lenoir Thompson, of Perdido,.

In nomenclature and classification Stejneger and Barbour's check-list is followed pretty closely, but in cases where different technical names have been used in more accessible works, such as those of Cope and Ditmars, * such names are added in parentheses to facilitate identification.

Besides the species which have been actually collected in Alabama by the author or others a few additional ones are included which from what is known of their distribution may be reasonably expected in this state, to stimulate interested persons to be on the lookout for them. Our present knowledge of their distribution is indicated in each case. Information about species not listed, Alabama localities for those listed as probable, new localities for species already known in the state, and corrections of any kind, will be welcomed, and may be communicated either to the author, at the Gem Floral Garden, Mobile, or to the State Geologist, at University.

*For more exact citations see appendix.

SYSTEMATIC LIST.

FAMILY: NECTURIDAE

GENUS: **NECTURUS**, Rafinesque.

NECTURUS MACULOSUS Rafinesque (*N. maculatus* Cope)

WATERDOG, MUDPUPPY

Type locality: Ohio River.

General Distribution: Eastern United States, mostly in the Mississippi valley and northeastward.

Alabama records: Colbert, Tuscaloosa and Montgomery counties; Warrior River.

NECTURUS PUNCTATUS (Gibbes) Cope

MUDPUPPY

Type locality: Near mouth of Santee River, South Carolina.

General distribution: Fresh waters of North and South Carolina, and Alabama.

Alabama records: Eslava's Creek, Mobile County; six specimens collected by my son, Christian Loding.

FAMILY: AMPHIUMIDAE

GENUS: **AMPHIUMA**, Garden.

AMPHIUMA MEANS Garden

CONGO-SNAKE, CONGER-EEL, LAMPEREEL

Type locality: Not given, but probably South Carolina or East Florida.

General distribution: Virginia south to Florida west to Louisiana.

Alabama records: Mobile and Geneva Counties; in ditches and swamps.

In view of the bad reputation of this animal, which is commonly believed to cause death by its bite, it may be well to state, that the *Amphiuma* is non-poisonous and from my experience in handling many specimens I should say entirely harmless.

AMPHIUMA TRIDACTYLUM Cuvier
THREE-TOED CONGO-SNAKE

Type locality: New Orleans, Louisiana.
General distribution: Northern Florida to Louisiana, up the Mississippi Valley to Missouri.
Alabama records: Greensboro, Hale County.

FAMILY: CRYPTOBRANCHIDAE

GENUS: CRYPTOBRANCHUS, Leuckart.

CRYPTOBRANCHUS ALLEGANIENSIS (Daudin) Cope
HELL-BENDER

Type locality: Allegheny Mountains, Virginia.
General distribution: Western New York, the Great Lakes system, Iowa and southward to Georgia and Louisiana.
Alabama records: None.

FAMILY: SALAMANDRIDAE, (Pleurodelidae)

GENUS: NOTOPHTHALMUS, Rafinesque.

NOTOPHTHALMUS MERIDIONALIS (Cope)
Stejneger & Barbour
(*Diemyctylus viridescens meridionalis* Cope)

Type locality: Mexico.
General distribution: Southern Georgia to Louisiana, Texas and Mexico.
Alabama records: None.

NOTOPHTHALMUS VIRIDESCENS VIRIDESCENS
(Rafinesque)
(*Diemyctylus viridescens* Cope)
COMMON NEWT (aquatic form), RED EFT (terrestrial form)

Type locality: Lake George, Lake Champlain.
General distribution: Eastern North America.
Alabama records: Mobile and Lawrence Counties; common under logs in winter (terrestrial form) and in ponds in summer (aquatic form).

FAMILY: AMBYSTOMIDAE

GENUS: AMBYSTOMA, Tschudi. (Also spelled Amblystoma.*)

AMBYSTOMA CINGULATUM Cope (*Chondrotus cingulatus* Cope)

Type locality: Grahamville, South Carolina.

General distribution: South Carolina to Northern Florida and Alabama.

Alabama records: Monte Sano, Madison County, Dog River, Mobile County; Magnolia Springs, Baldwin County (H. H. Smith).

AMBYSTOMA MACULATUM (Shaw) Stejneger (*A. punctatum* Cope)

SPOTTED SALAMANDER

Type locality: Carolina.

General distribution: Nova Scotia to Wisconsin, Georgia and Texas.

Alabama records: University, Tuscaloosa County; one specimen, March 15, 1913.

AMBYSTOMA OPACUM (Gravenhorst)

MARBLED SALAMANDER, OPAQUE SALAMANDER

Type locality: New York.

General distribution: Eastern United States.

Alabama records: Monte Sano, Madison County; Moulton, Lawrence County; Tuscaloosa County; Wetumpka, Elmore County; Sumter County; Salco, Mobile County; lives under logs and rocks.

The Salco specimens seem to be uniformly smaller and the markings are more pronounced, than the specimens I have taken in the northern part of the State.

AMBYSTOMA TALPOIDEUM (Holbrook) Gray

MOLE SALAMANDER

Type locality: Sea islands on the border of South Carolina.

*See Science II, 43:929-930; 44:309-311, 1916.

General distribution: South Atlantic and Gulf States, Louisiana to Illinois.

Alabama records: None.

AMBYSTOMA TIGRINUM (Green) Baird
TIGER SALAMANDER

Type locality: Near Moorestown, New Jersey.

General distribution: United States west to Rocky Mountains and south to Northern Mexico.

Alabama records: Bibb and Montgomery Counties; City of Mobile, several specimens.

FAMILY: PLETHODONTIDAE

GENUS: HEMIDACTYLIUM, Tschudi.

HEMIDACTYLIUM SCUTATUM (Schlegel) Tschudi
FOUR-TOED SALAMANDER

Type locality: Nashville, Tennessee.

General distribution: Southern Canada and Eastern United States.

Alabama records: Duncanville, Tuscaloosa County.

GENUS: PLETHODON, Tschudi.

PLETHODON AENEUS Cope (Am. Nat. 15:878, 1881)

Type locality: Nickajack Cave, (about 1-2 mile north of the northeastern corner of Alabama.)

General distribution: Mountains of Virginia to Georgia. This may be reasonably expected in some of the caves of northeastern Alabama.

PLETHODON DORSALIS (Cope) Stejneger & Barbour
(*P. cinereus dorsalis* Cope)

Type locality: Salem, Massachusetts (?) and Louisville, Kentucky.

General distribution: Southern Illinois, southern Ohio, southern Indiana, western Kentucky, and Alabama.

Alabama records: Gallant, St. Clair County, and University, Tuscaloosa County.

PLETHODON GLUTINOSUS (Green) Tschudi
SLIMY SALAMANDER, WATER LIZARD

Type locality: Not given, but without doubt Princeton, New Jersey.

General distribution: Eastern United States.

Alabama records: DeKalb, Lawrence, St. Clair, Tuscaloosa, Macon, Montgomery, Barbour, Marengo, Dale, Mobile and Baldwin counties.

GENUS: GYRINOPHILUS, Cope.

GYRINOPHILUS PORPHYRITICUS (Green) Cope

Type locality: French Creek, near Meadville, Crawford County, Pennsylvania.

General distribution: Southern Canada, south through the eastern states to Kentucky, Ohio and Tennessee.

Alabama records: None, but has been found on Lookout Mountain, Tennessee.

GENUS: MANCULUS, Cope.

MANCULUS QUADRIDIGITATUS (Holbrook) Cope
DWARF SALAMANDER

Type locality: South Carolina, Georgia and Florida.

General distribution: North Carolina to Florida and Texas.

Alabama records: Mobile and Baldwin Counties.

GENUS: EURYCEA, Rafinesque.

EURYCEA BISLINEATA CIRRIGERA Green

Type locality: New Orleans, Louisiana.

General distribution: Southern Georgia, northern Florida, Alabama, southern Mississippi, and southeastern Louisiana (E. R. Dunn).

Alabama records: Mobile; Baldwin, Tuscaloosa; Bibb; St. Clair; Calhoun; Chilton; Barbour and Dale Counties.

EURYCEA GUTTO-LINEATA (Holbrook) Stejneger & Barbour
(*Spelerpes guttolineatus*, Cope)
HOLBROOK'S SALAMANDER

Type locality: "Carolina in the middle country."

General distribution: Virginia to Georgia and west to Louisiana.

Alabama records: Madison; Tuscaloosa; Greene; Mobile and Baldwin Counties.

EURYCEA LONGICAUDA (Green) Stejneger & Barbour
(*Spelerpes longicaudus* Cope)
LONG-TAILED SALAMANDER

Type locality: New Jersey (probably near Princeton).

General distribution: Southern New England to Florida and Louisiana, west to Illinois and Missouri.

Alabama records: Monte Sano, Madison County.

EURYCEA LUCIFUGA Rafinesque
(*Gyrinophilus maculicaudus* Cope)

Type locality: Caves near Lexington, Kentucky.

General distribution: West Virginia to Tennessee, also Indiana, Illinois and Missouri.

Alabama records: According to E. R. Dunn there is a larva of this species in the Museum of Comparative Zoology (No. 225) with no other locality label than Alabama, and specimens have been taken just over the line in Marion county, Tennessee.

EURYCEA MONTANA FLAVISSIMA (Hallowell)

Type locality: Liberty County, Georgia.

General distribution: Southern Georgia, northern Florida, southern Alabama, southern Mississippi, and southeastern Louisiana (E. R. Dunn).

Alabama records: Auburn, Lee County, and Mobile.

EURYCEA RUBRA RUBRA (Sonnini) (*Spelerpes ruber*, Cope)
RED SALAMANDER

Type locality: United States.

General distribution: Eastern United States.

Alabama records: Madison, Etowah, and St. Clair Counties; Anniston, Calhoun County; Tuscaloosa.

GENUS: DESMOGNATHUS, Baird.

DESMOGNATHUS FUSCUS FUSCUS (Rafinesque)

Type locality: Northern parts of New York State.

General distribution: Southern Canada to mountains of Carolinas, Georgia and Alabama.

Alabama records: Lauderdale; Calhoun; Tuscaloosa; Lee; Greene and Marengo Counties.

DESMOGNATHUS FUSCUS AURICULATUS (Holbrook)
EARED SALAMANDER

Type locality: Riceborough, Georgia.

General distribution: Lowlands from Virginia to Florida and Gulf States.

Alabama records: Lauderdale; Madison; Tuscaloosa; Bibb; Mobile and Baldwin Counties.

FAMILY: SIRENIDAE

GENUS: SIREN, Linne.

SIREN LACERTINA Linne
TWO-LEGGED EEL, MUD-EEL

Type locality: "Habitat in Carolinae paludosis."

General distribution: Eastern Virginia to Florida., Gulf States to the west side of Rio Grande, Mississippi Valley to Illinois and Indiana. Occurs also in Arkansas and Missouri.

Alabama records: Spring Hill Reservoir, Mobile County.

FAMILY: SCAPHIOPODIDAE

GENUS: SCAPHIOPUS, Holbrook.

SCAPHIOPUS HOLBROOKII HOLBROOKII (Harlan)
HERMIT SPADEFOOT

Type locality: South Carolina.

General distribution: Eastern States, Massachusetts to Florida, west to Texas and Arkansas.

Alabama records: Mobile County.

This species has only been taken rarely and always singly, until in the late fall of 1918, when I caught six specimens in and about the boiler pit of my greenhouses.

FAMILY: BUFONIDAE

GENUS: BUFO, Laurenti.

BUFO AMERICANUS Holbrook
(*B. lentiginosus americanus*, Cope)
AMERICAN TOAD

Type locality: "From Maine through all the Atlantic States."

General distribution: Eastern North America from Hudson Bay southward.

Alabama records: I have no definite records or identifications of this toad for the State.

BUFO FOWLERI Garman (*B. lentiginosus fowleri*, Cope)
FOWLER'S TOAD

Type locality: "Manitoba to Winnipeg; Massachusetts."

General distribution: New England and New York, southward to Georgia, west to Michigan.

Alabama records: Calhoun, Tuscaloosa, and Mobile counties.

BUFO QUERCICUS Holbrook
OAK TOAD

Type locality: Charleston, South Carolina and Smithville (now Southport), North Carolina.

General distribution: North Carolina to Florida and Alabama.

In Mobile County this little toad is rather common in high sandy locations with Scrub Oak and Palmetto undergrowth.

Alabama records: Mobile and Baldwin Counties.

BUFO TERRESTRIS Bonnaterre (*B. lentiginosus* Shaw)
SOUTHERN TOAD

Type locality: "La Caroline."

General distribution: Carolinas to Florida and west to Mississippi.

Alabama records: Montgomery, Mobile, and Baldwin Counties, probably over the State.

FAMILY: HYLIDAE

GENUS:: ACRIS, Dumeril and Bibron.

ACRIS GRYLLUS (LeConte) Dum. & Bibr.
CRICKET-FROG

Type locality: Not given.

General distribution: Eastern half of the United States and northward.

Alabama records: Marengo County (Cope); Mobile County.

GENUS: PSEUDACRIS, Fitzinger.

PSEUDACRIS NIGRITA (LeConte) Gunther
(*Chorophilus nigritus* Cope)
SWAMP TREE FROG

Type locality: Not given.

General distribution: South Carolina to Mississippi.

Alabama records: Mobile County.

PSEUDACRIS OCCIDENTALIS (Baird and Girard) Stejneger and Barbour
(*Chorophilus occidentalis* Cope)

Type locality: Unknown.

General distribution: Georgia and Florida, west to Arkansas and Texas.

Alabama records: Mobile County.

PSEUDACRIS ORNATA (Holbrook) Stejneger & Barbour
(*Chorophilus ornatus* Cope)

Type locality: Charleston, South Carolina.

General distribution: South Carolina to Florida, west to Texas.

Alabama records: None.

GENUS: HYLA, Laurenti.

HYLA CINEREA (Schneider) Garman, (*H. carolinensis*, Cope)

Type locality: "Inhabits Carolina."

General distribution: Virginia to Florida, west to Texas and northward up the Mississippi Valley to Southern Illinois.

Alabama records: Tuscaloosa, Montgomery, Mobile and Baldwin Counties.

HYLA CRUCIFER Wied (*H. pickeringii* (Holbrook) Cope)
SPRING-PEEPER, PICKERING'S FROG

Type locality: Kansas.

General distribution: New Brunswick to Manitoba, south to South Carolina, Louisiana, Arkansas and Kansas.

Alabama records: Mobile County.

HYLA FEMORALIS Latreille
PINE-WOOD TREE FROG

Type locality: Carolina.

General distribution: Carolina to Florida and west to Texas.

Alabama records: Tuscaloosa; Mobile; and Baldwin counties. Common in the last two counties, and probably over the State.

HYLA GRATIOSA LeConte
FLORIDA TREE-FROG

Type locality: Lower country of Georgia.

General distribution: South Carolina to Florida and Mississippi.

Alabama records: University, Tuscaloosa County; Kelly's Pond, Mobile County.

This, the largest of our tree-frogs seemed to be very rare previous to the hurricane of July, 1916, up to which time in all our collecting only two adults and two very young specimens had been taken; but suddenly during August of that year the species became very common, in fact could be seen by the thousands in the Satsuma orange orchards through Mobile County. Since then it has gradually become scarcer and at present is not seen very often.

HYLA SQUIRELLA Latreille
SOUTHERN TREE-FROG

Type locality: Carolina.

General distribution: Virginia to Florida, west to Texas and up the Mississippi to Indiana.

Alabama records: Mobile county.

HYLA VERSICOLOR VERSICOLOR (LeConte)
CHAMELEON TREE-FROG, RAIN TOAD

Type locality: "Northern States."

General distribution: From Southern Canada west to Minnesota and South to the Gulf States.

Alabama records: Tuscaloosa, Greene (Cope), and Mobile Counties. Our most common Tree-Frog.

FAMILY: RANIDAE

GENUS: RANA, Linne.

RANA AREOLATA Baird and Girard

Type locality: Indianola, Texas.

General distribution: From Florida to Texas and up the Mississippi to Missouri, Indiana and Illinois.

Alabama records: Dog River, Mobile County, August 10, 1919.

RANA CATESBEIANA Shaw
COMMON BULLFROG

Type locality: North America.
General distribution: United States, east of the Rocky Mountains.
Alabama records: Tuscaloosa and Mobile Counties, but probably found all over the State.

RANA CLAMITANS Latreille (*R. clamata* Cope)
GREEN FROG, SPRING FROG

Type locality: Charleston, South Carolina.
General distribution: Eastern North America.
Alabama records: Tuscaloosa, Greene (Cope), Montgomery, Mobile and Baldwin counties.

RANA GRYLIO Stejneger
SOUTHERN BULLFROG

Type locality: Bay St. Louis, Mississippi.
General distribution: Southern Mississippi to peninsular Florida.
Alabama records: None; however, the distinctive note of this frog has been heard by the writer and others in Mobile County.

RANA PALUSTRIS LeConte
PICKEREL FROG

Type locality: Not given.
General distribution: Hudson Bay south to Arkansas and Louisiana and all of the eastern states.
Alabama records: None.

RANA SPHENOCEPHALA (Cope) Stejneger & Barbour
(*R. virescens sphenocephala*, Cope)
SOUTHERN LEOPARD FROG

Type locality: Near St. John's River, Florida.
General distribution: Southeastern United States.

Alabama records: Tuscaloosa, Montgomery and Mobile Counties.

FAMILY: BREVICIPITIDAE
GENUS: GASTROPHRYNE, Fitzinger.

GASTROPHRYNE CAROLINENSIS (Holbrook) Stejneger and Barbour
(*Engystoma carolinense* Holbrook)
NARROW-MOUTHED TOAD

Type locality: Charleston, South Carolina.

General distribution: Virginia to Florida and Texas, northward through the central valley to southern Indiana.

Alabama records: Cherokee, Etowah, Calhoun, St. Clair, Tuscaloosa, Mobile and Baldwin Counties.

FAMILY: CROCODYLIDAE

GENUS: CROCODYLUS, Laurenti (Crocodilus).

CROCODYLUS ACUTUS Cuvier (*"C, americanus"*)

Type locality: San Domingo.

General distribution: Southern Florida and tropical America.

Alabama records: A young specimen about three feet long was caught after a cloudburst in the outskirts of Mobile; as in similar cases it was said to have come down with the rain. Mr. T. S. van Aller purchased the specimen and later on presented it to the Alabama Museum of Natural History. Diligent search and examination of numerous alligators in the hope of finding other specimens so as to establish the species as indigenous to the State have thus far been in vain.

GENUS: ALLIGATOR, Cuvier.

ALLIGATOR MISSISSIPPIENSIS (Daudin) Gray

Type locality: "Les bordes du Mississippi."

General distribution: Rivers and swamps of the coastal plain from North Carolina to Florida, Oklahoma, and Texas.

Alabama records: Mobile and Baldwin Counties; not uncommon up rivers to Selma and Eutaw or thereabouts.*

Mr. Julius Hurter and the writer on a collecting trip to Baldwin County witnessed a captive alligator struggling for its liberty expel three large specimens of a water snake, *Natrix rhombifera.*

*On a trip by house-boat from Tuscaloosa to Jackson in October, 1908, a small dead alligator was seen in the river, about 50 miles below Tuscaloosa, but no live ones on the whole trip. The bridge tender at Epes on the Tombigbee when interrogated recently said he knew of no alligators in the river there. A small specimen was found in the Warrior River near Tuscaloosa July 23, 1922, but it may possibly have escaped from captivity. The distribution of this species seems to be much like that of the Spanish moss. (*Tillandsia usneoides*). R. M. HARPER.

FAMILY: IGUANIDAE

GENUS: ANOLIS, Daudin.

ANOLIS CAROLINENSIS Voigt
AMERICAN CHAMELEON

Type locality: Carolina.

General distribution: North Carolina to Florida and westward through the Gulf region to the Rio Grande.

Alabama records: DeKalb, Talladega, Tuscaloosa, Bibb; Greene; Sumter; Dale and Mobile counties.

The value of this beautiful little lizard as an insect destroyer has been observed for many years in my green houses, where they breed by the hundreds and the eggs may be found abundantly in fern pots.

GENUS: SCELOPORUS, Wiegmann.

SCELOPORUS SPINOSUS FLORIDANUS (Baird) Stejneger
SPINY SWIFT, FLORIDA SWIFT

Type locality: Pensacola, Florida.

General distribution: New Mexico to western Florida.

Alabama records: Elamville, Barbour County; Mobile and Baldwin counties.

SCELOPORUS UNDULATUS (Latreille) Wiegmann
FENCE LIZARD, COMMON SWIFT, ALLIGATOR LIZARD

Type locality: "Les grands bois de la Caroline."

General distribution: New Jersey to Florida and Alabama.

Alabama records: Tuscaloosa, Greene, Montgomery, Mobile and Baldwin counties, most likely over the State.

Horned Toads (genus *Phrynosoma*) are occasionally found in our cities, but doubtless escaped from captivity, for they are not known to occur naturally east of Missouri.

FAMILY: ANGUIDAE

GENUS: OPHISAURUS, Daudin.

OPHISAURUS VENTRALIS (Linne) Daudin
GLASS SNAKE, JOINT SNAKE

Type locality: Carolina.

General distribution: North Carolina to Florida in the East, Nebraska, Wisconsin and Illinois south into Mexico.

Alabama records: St. Clair, Tuscaloosa, Mobile, and Baldwin counties.* Very common in and around Mobile.

FAMILY: TEIIDAE

GENUS: CNEMIDOPHORUS, Wagler.

CNEMIDOPHORUS SEXLINEATUS (Linne) Dum. & Bibr.
SIX-LINED LIZARD, RACE-RUNNER

Type locality: Carolina.

General distribution: Maryland to Florida, west to northern Mexico and Arizona and up the Mississippi Valley to Lake Michigan.

Alabama records: Tuscaloosa, Greene, Montgomery, Baldwin and Mobile counties.

FAMILY: SCINCIDAE

GENUS: LEIOLOPISMA, Dumeril and Bibron.

LEIOLOPISMA LATERALE (Say) Jordan (*Lygosoma laterale*)
GROUND LIZARD

Type locality: Banks of Mississippi River below Cape Girardeau, Missouri.

General distribution: Maryland to Florida, west to Illinois and Texas.

Alabama records: Mobile, Baldwin and Etowah counties.

---

*I saw one in a road in Walker County in October, 1911. R. M. Harper.

GENUS: PLESTIODON, Dumeril and Bibron.

PLESTIODON FASCIATUS (Linne) Baird
(*Eumeces quinquelineatus* Bocourt)
SCORPION, BLUE-TAILED SKINK, FIVE-LINED LIZARD, RED-HEADED LIZARD

Type locality: Carolina.

General distribution: Southern New England to Florida, up the Mississippi Valley to Canada, westward to Arizona.

Alabama records: Calhoun, Tuscaloosa, Bibb, Greene, Sumter, Montgomery, Choctaw, Mobile and Baldwin counties.

PLESTIODON PLUVIALIS (Cope)

Type locality: Mobile, Alabama.

General distribution: "Central Gulf Area." (Stejneger and Barbour.)

Alabama records: We only know of the type specimen, which, according to Cope, was taken near Mobile, Alabama, by Dr. Joseph Corson, U. S. A., and deposited in the Cope Collection, Academy of Natural Sciences of Philadelphia.

Intensive collecting and examination of hundreds of specimens, all evidently belonging to the previous species, by Mr. van Aller and the writer in Mobile and Baldwin Counties has failed to turn up another record.

FAMILY: COLUBRIDAE

GENUS: **CARPHOPHIS**, Gervais.

CARPHOPHIS AMOENUS (Say) Gervais
(*Carphophiops amoenus* Cope)
WORM SNAKE

Type locality: Pennsylvania.

General distribution: Connecticut to Florida, westward to Ohio, Illinois and Indiana.

Alabama records: Madison, Blount, DeKalb, Etowah, St. Clair, Tuscaloosa and Sumter (E. T. Norman) counties.

This snake was found plentiful under rocks in the mountainous counties, by Mr. van Aller and myself; it does not seem to be found in the coast counties.

GENUS: **ABASTOR**, Gray.

ABASTOR ERYTHROGRAMMUS (Daudin) Gray
RAINBOW SNAKE

Type locality: "Etats Unis d'Amerique."

General distribution: Virginia southward to Florida and Alabama.

Alabama records: Walker Count (H. H. Smith); Tuscaloosa County; Crichton, Mobile County; Balwin County.

GENUS: **FARANCIA**, Holbrook.

FARANCIA ABACURA (Holbrook) Cope
HORN SNAKE, HOOP SNAKE, MUD SNAKE

Type locality: South Carolina.

General distribution: Virginia to Florida and Louisiana, northward in the Mississippi Valley to Indiana.

Alabama records: Many specimens from various parts of Mobile County and Tuscaloosa County.

From the number of mutilated specimens seen, this snake must evidently be very common on the coast. The common belief that it is dangerous and can inflict deadly wounds with the awl-like tip of its tail, is, needless to say, without any foundation of fact, and the same may be said of the previous species.

GENUS: **DIADOPHIS**, Baird and Girard.

DIADOPHIS PUNCTATUS (Linne) Baird & Girard
RING-NECKED SNAKE

Type locality: Carolina.

General distribution: Eastern United States.

Alabama records: Lawrence, Tuscaloosa, Mobile, and Baldwin counties; under logs and sphagnum moss in moist places.

GENUS: **HETERODON**, Latreille.

HETERODON CONTORTRIX (Linne) Stejneger & Barbour
(Formerly called *H. platyrhinus*)
SPREADING ADDER, BLOWING ADDER, HOG-NOSED SNAKE

Type locality: Carolina.

General distribution: Eastern United States.

Alabama records: Tuscaloosa, Hale, Greene, Sumter, Montgomery, Clarke, Mobile and Baldwin counties.

The Spreading Adder has an undeserved bad reputation; it is absolutely harmless and may be handled with impunity without fear of even a bite.

The black form of this snake passing under the specific or varietal name of *niger* is found in Mobile and Tuscaloosa counties with the typical form.

HETERODON SIMUS (Linne) Holbrook
HOG-NOSED SNAKE, SPREADING ADDER

Type locality: Carolina.

General distribution: Southeastern States, Indiana to Florida.

Alabama records: Perdido, Baldwin County (Lenoir Thompson).

GENUS: **LIOPELTIS**, Fitzinger.

LIOPELTIS VERNALIS (Harlan) Cope
SMOOTH GREENSNAKE

Type locality: Pennsylvania and New Jersey.

General distribution: Canada to Florida and New Mexico, commonest northeastward.

Alabama records: None.

GENUS: **OPHEODRYS**, Fitzinger.

OPHEODRYS AESTIVUS (Linne) Cope
(*Cyclophis aestivus* Cope)
ROUGH GREENSNAKE

Type locality: Carolina.

General distribution: New Jersey to Florida, west to New Mexico and northward to Kansas and Illinois.

Alabama records: Etowah, Jefferson, Tuscaloosa, Montgomery, and Mobile counties.

Usually found climbing in trees and hedges.

GENUS: **COLUBER**, Linne.

COLUBER CONSTRICTOR CONSTRICTOR (Linne)
(*Zamenis constrictor* Boulenger, *Bascanium constrictor* Baird and Girard
BLACK SNAKE, BLACK RACER

Type locality: North America.

General distribution: Eastern United States westward to Texas and the Great Plains.

Alabama records: St. Clair, Shelby, Tuscaloosa, Sumpter, Mobile and Baldwin counties. Probably common throughout the State.

COLUBER FLAGELLUM FLAGELLUM (Shaw)
(*Zamenis flagellum flagellum* Cope; *Bascanium flagelliforme* Cope)
COACH WHIP, WHIP SNAKE

Type locality: Virginia and Carolina.

General distribution: Virginia to Florida, west to the Rocky Mountains.

Alabama records: Tuscaloosa, Sumter, Barbour and Mobile counties. Not uncommon in dry fields and cut over pine lands in Mobile county.*

This species and the preceding are probably the most useful snakes in the State, on account of their food habit, which consists largely of rats and mice, and their general common occurrence within its borders.

*I have seen this snake in pine forests on and near the mountains in Cleburne and Clay Counties, and on May 28, 1921, I saw one swimming across the Locust Fork of the Warrior River near the mouth of Village Creek, Jefferson County. R. M. Harper.

GENUS: ELAPHE, Fitzinger.

ELAPHE GUTTATA (Linne) (*Coluber guttatus* Linne)
CORN-SNAKE, CHICKEN SNAKE, SCARLET RACER

Type locality: Carolina.

General distribution: Maryland to Florida and Louisiana.

Alabama records: St. Clair, Tuscaloosa, Mobile and Baldwin counties.

A beautiful and useful snake commonly found under bark of dead pine trees in early spring.

ELAPHE OBSOLETA OBSOLETA (Say) *Coluber obsoletus obsoletus* (Cope)
PILOT-SNAKE, BLACKSNAKE

Type locality: "Isle au Vache to Council Bluffs on the Missouri river.

General distribution: New England westward to Michigan, southward to Florida and Texas.

Alabama records: None. The record of Cope (Rep. U. S. Nat. Mus. 1889, p. 846) based upon catalogue No. 5502, Sprout River, Alabama, proves upon examination by Dr. Stejneger to be a mistake and should read: Sprout River or Spout River, Arkansas.

ELAPHE OBSOLETA CONFINIS (Baird and Girard)
Stejneger & Barbour (*Coluber confinis* Cope)
GRAY RAT-SNAKE, SPOTTED CHICKEN-SNAKE

Type locality: Anderson, South Carolina.

General distribution: South Atlantic and Gulf States.

Alabama records: Cherokee, St. Clair, Tuscaloosa, Bibb, Montgomery and Mobile counties.

A specimen recently examined by the writer measured six feet and three inches.

ELAPHE QUADRIVITTATA (Holbrook) Dum. & Bibr.
(*Coluber quadrivittatus* Holbrook)
YELLOW CHICKEN-SNAKE, YELLOW RAT-SNAKE

Type locality: North Carolina to Florida and west to the Mississippi River.

General distribution: Same as given for type locality.
Alabama records: None.

GENUS: **DRYMARCHON**, Fitzinger.

DRYMARCHON CORAIS COUPERI (Holbrook) Strecker
(*Spilotes* or *Compsosoma*, Cope)
INDIGO-SNAKE, GOPHER-SNAKE

Type locality: Dry pine hills south of the Altamaha, Georgia.
General distribution: Carolinas to Florida and westward to Texas.
Alabama records: Satsuma, Mobile County.
The writer has seen several specimens on the sandy palmetto covered hills at Grand Bay, Mobile County, but has never been able to capture a specimen.

GENUS: **PITUOPHIS**, Holbrook. (Also spelled **Pityophis.**)

PITUOPHIS MELANOLEUCUS (Daudin) Holbrook
(black form)
BLACK BULL-SNAKE, PINE-SNAKE

Type locality of species: South Carolina and Florida.
Type locality of black form: Southwestern part of Mobile County.
General distribution: Pine barrens of southern New Jersey to Florida and Alabama
Alabama records: Abott's Station, Grand Bay, and Irvington, Mobile County.
A harmless, docile and very useful species.
In this connection the following note and description by Dr. F. N. Blanchard in *Copeia* (No. 81, New York. April, 1920), are of importance.

A BLACK PITUOPHIS

My friend, Mr. H. P. Loding, of Mobile, Alabama, recently sent me for examination a large *Pituophis*, remarkable for being uniformly black above and below, except for a little rusty color on the anterior part of the head and flecks of rust on the ends of some of the ventral scales.
This is apparently the first example of its genus to be reported from Alabama, and, so far as I know, there are no records for Georgia, Mississippi, and Louisiana. This specimen was found dead on the Hall's Mill Road, in the vicinity of high sandy hills

near Hall's Mill Creek, about 14 miles southwest of Mobile. A second specimen, which Mr. Loding informs me is like this one, was taken alive at Grand Bay, 26 miles southwest of Mobile by Dr. E. D. King, Jr. The latter, a female, was kept in confinement for over a week, but refused to eat, so was preserved and deposited in the Charles Mohr Museum in Mobile.

As Mr. Loding and his friends have been collecting reptiles in the vicinity of Mobile for several years, it would seem as if the ordinary patterned form of *Pituophis* would have been found if it occurred at all commonly in Mobile County. On the other hand the black form was not found until this past season. Possibly, however, it had been confused in the field with some of the more common large black snakes, as *Drymarchon corais couperi* and *Coluber constrictor constrictor*.

The finding of the two black specimens of *Pituophis* so far apart as twelve miles, and the absence of records for normally colored individuals, suggest the exclusive occurrence in this region of a black phase of the Bull Snake.

That all the North American bull snakes are very closely related can hardly be doubted. In fact, it appears that only color pattern can be relied upon to distinguish them with certainty. We would expect therefore to find each species of *Pituophis* directly related to the one inhabiting the adjacent range. We would not then look for a black form occupying a range between the ranges of the two closely allied pattern forms. In the United States National Museum there are two examples of *Pituophis* (No. 10363) From Murphy (near Knoxville), Tennessee, patterned like the eastern species, *P melanoleucus*. Our black phase could therefore not extend further north than this point, and it is very likely that it will prove to be restricted to the extreme south where it is now found. If the Gulf Coast may be regarded as in general unfavorable to the bull snakes, we may readily understand how a local color phase may have become established in a limited region of favorable habitat.

As there are no other specimens of *Pituophis* on record from this southern tier of states, and since it is chiefly on color characters that the nearest species, *P. Sayi* and *P. melanoleucus* are distinguished, it is rather difficult to assign this black form definitely to either one. The two specimens from Murphy, Tennessee are undoubtedly *P. melanoleucus*. This is perhaps the most western definite record for the eastern species. How much further west it may extend can only be conjectured. Eastern records for *P. sayi* seem to be limited to Illinois, but numerous western species of reptiles are known east of the Mississippi River only in Illinois and Indiana. These facts, and the apparently unfavorable habitat of the lower Mississippi River region, suggest that *P. melanoleucus* may occupy all the favorable areas in the southern states as far west as the Mississippi River. In that case our black specimens may be regarded as a local phase of *P. melanoleucus*.

Carination and scutellation are admittedly unsatisfactory in distinguishing *P. sayi* from *P. melanoleucus*. Our black example has five rows of smooth scales on the sides, and Mr. Loding informs me that the other specimen has the same number. This, while within the extreme of *P. melanoleucus* comes perhaps closer to the average for *P. sayi*. Similarly, the rostral dividing the internasals for only two thirds of their width rather suggests *P. sayi*. However, the Tennessee specimens, mentioned above, are practically like this black individual in carination and shape and size of rostral, while definitely *P. melanoleucus* in pattern. It therefore seems more satisfactory to assign these black specimens provisionally to *P. melanoleucus*.

The finding of more examples of *Pituophis* from these southern states will be awaited with much interest.

Following is a description of the black example from 14 miles southwest of Mobile, now deposited, through the kindness of Mr. Loding, in the United States National Museum (No. 62340):

Ventrals, 225; anal, single and entire; 57 divided caudals; upper labials, 8 on each side, lower labials 13 on the left side and 15 on the right; one preocular on each side; 4 postoculars on the left side and probably four on the right; about 4 remporals in the first row; rostral dividing the internasals for two thirds of their width; maximum number of scale rows, 29, anteriorly, 27, posteriorly 21; keels on dorsal scales prominent above, progressive fainter on the sides, descending as low as the sixth row anteriorly and the third row posteriorly. Total length 1800 millimeters; tail length 221 millimeters. Sex, female.

The coloration (by reference to Ridgway's Color Standards and Nomenclature) is often as follows: Above, fuscous black; below, slate color; on the head, between the parietals and the rostral, and including the upper labials, most of the scales having in their centers a development of orange-cinnamon mixed with the fuscus black; ocasionally ventral scales, except on the anterior portion of the body, with flecks of perhaps an ivory yellow, or lighter, near their ends; and, along the sides of the tail and near its end, on most of the subcaudal scutes, some lighter coloration showing faintly through the black.

FRANK N. BLANCHARD,
University of Michigan.

GENUS: **LEIMADOPHIS**, Fitzinger.

LEIMADOPHIS FLAVILATUS (Cope) Stejneger & Barbour
(*Rhadinea flavilata*, Cope)
YELLOW-LIPPED SNAKE

Type locality: Fort Macon (near Beaufort) North Carolina.

General distribution: North Carolina to Florida and Alabama.

Alabama records: Mobile County, not uncommon in low cut-over pine lands under logs in early spring.

GENUS: **LAMPROPELTIS**, Fitzinger.*

LAMPROPELTIS ELAPSOIDES (Holbrook) Stejneger & Barbour
(*Osceola elapsoidea*, Baird & Girard)
SCARLET KING SNAKE, OSCEOLA SNAKE, THUNDER SNAKE

Type locality: South Carolina and Georgia.

General distribution: North Carolina to Florida and west to New Orleans.

Alabama records: Mobile, Russell and Tuscaloosa counties.

Usually found early in the spring under logs and bark of dead pine trees.

LAMPROPELTIS GETULUS GETULUS (Linne) Cope
(*Ophibolus*, Cope)
KING-SNAKE, CHAIN-SNAKE

Type locality: Carolina.

General distribution: New Jersey to Central Florida west into Alabama.

Alabama records: Talladega and Baldwin counties.

A useful species.

LAMPROPELTIS GETULUS HOLBROOKI, Stejneger
(*Ophibolus getulus sayi*, Cope)

Type locality: Valley of the Mississippi.

General distribution: Western Alabama to Central Texas; north to Illinois and Indiana.

Alabama records: Mobile and Tuscaloosa counties.

LAMPROPELTIS GETULUS NIGER, (Yarrow)

Type location: Wheatland, Indiana.

General distribution: Indiana to Northern Alabama.

Alabama records: Colbert, Etowah, Calhoun, and Talladega counties.

*An exhaustive treatise of this genus may be found in Bull. 114, U. S. Nat. Mus.: A Revision of the King Snakes, by Frank N. Blanchard, 1921.

LAMPROPELTIS RHOMBOMACULATA (Holbrook) Cope
(*Ophibolus rhombomaculatus*, Baird & Girard)
Brown King-Snake, Molecatcher

Type locality: Georgia and Alabama.
General distribution: Maryland to Georgia and Alabama.
Alabama records: Mobile County.
A rare snake.

GENUS: **CEMOPHORA**, Cope.

CEMOPHORA COCCINEA (Blumenbach) Cope
Scarlet Snake

Type locality: Florida.
General distribution: Maryland to Florida and Louisiana.
Alabama records: Athens, Limestone County (Cope); University, Tuscaloosa County; Bayou la Batre, Mobile County.

GENUS: **NATRIX**, Laurenti. **(Tropidonotus**, Kuhl.)

NATRIX CLARKII (Baird & Girard) Cope
Salt Water Moccasin, Clark's Water Snake

Type locality: Indianola, Texas.
General distribution: Gulf Coast from western Florida west to Texas.
Alabama records: Mobile County, Bayous and beaches of the Mississippi Sound, Coden and Bayou la Batre.
This with other species of *Natrix* must be considered harmful in as much as their food consists largely of fish and frogs.

NATRIX CYCLOPIUM (Dumeril & Bibron) Cope
Green Water Snake

Type locality: New Orleans.
General distribution: Florida to Louisiana and up the Mississippi Valley to Southern Illinois.
Alabama records: University, Tuscaloosa County, Three Mile Creek, Mobile County.

NATRIX RHOMBIFERA (Hallowell) Cope
DIAMOND-BACK WATER SNAKE

Type locality: Arkansas River.

General distribution: Southern Illinois and Indiana, south to Texas, Louisiana and Alabama.

Alabama records: Mobile County, Kelly's Pond; common in ponds and creeks.

NATRIX RIGIDA (Say) Cope
STRIPED WATER SNAKE

Type locality: The Southern States.

General distribution: The Carolinas to Florida and Alabama.

Alabama records: Montgomery County; Chastang, and Mt. Vernon, Mobile County.

NATRIX SEPTEMVITTATA (Say) Cope (*N. leberis*, Cope)
QUEEN-SNAKE, MOON-SNAKE

Type locality: Pennsylvania.

General distribution: Central, Eastern and Gulf States.

Alabama records: Walker County, and University, Tuscaloosa County.

NATRIX SIPEDON FASCIATA (Linne) Stejneger & Barbour
(*N. fasciata*, Cope; *Tropidonotus fasciatus sipedon* Boulenger)
BANDED WATER SNAKE, MOCCASIN

Type locality: Carolina.

General distribution: Virginia to Florida, west to Louisiana, and northward up the Mississippi Valley to Nebraska and Illinois.

Alabama records: Etowah, St. Clair, Tuscaloosa, Mobile and Baldwin counties.

Common in rivers, ditches, ponds and creeks, and often mistaken for the true poisonous Water Moccasin.

NATRIX SIPEDON ERYTHROGASTER (Shaw) Forster
(*N. fasciata erythrogaster*, Cope)
RED-BELLIED WATER SNAKE

This according to Stejneger and Barbour is only a color variety of the former. It has been recorded from Jef-

ferson and Bibb Counties, University, Tuscaloosa County, and Mount Vernon, Mobile County.

NATRIX TAXISPILOTA (Holbrook) Cope
WATER-PILOT

Type locality: South Carolina seaboard and the Altamaha River, Georgia.

General distribution: The Carolinas to Florida, west to Louisiana.

Alabama records: None.

GENUS: STORERIA, Baird and Girard.

STORERIA DEKAYI (Holbrook) Baird & Girard
DEKAY'S SNAKE, GRASS-SNAKE, BROWN-SNAKE

Type locality: Massachusetts and New York.

General distribution: Eastern North America to Mexico.

Alabama records: University, Tuscaloosa County, Mobile County, very common.

STORERIA OCCIPITO-MACULATA (Storer) Baird & Girard
RED-BELLIED SNAKE, STORER'S SNAKE

Type locality: Amherst, Massachusetts.

General Distribution: Same as preceding

Alabama records: Cherokee, Calhoun, St. Clair, Tuscaloosa, Bibb, Conecuh, Mobile and Baldwin Counties.

GENUS: VIRGINIA, Baird and Girard.

VIRGINIA ELEGANS Kennicott

Type locality: Southern Illinois.

General distribution: Illinois, Indiana and Missouri. southward to Texas and eastward to Alabama.

Alabama records: Mobile County.

VIRGINIA VALERIAE Baird & Girard

Type locality: Kent County, Maryland.

General distribution: New Jersey to South Carolina, west to Tennessee and Alabama.

Alabama records: Indian Creek, Tuscaloosa County, (Herbert H. Smith, April 15, 1912).

GENUS: **POTAMOPHIS**, Fitzinger.

POTAMOPHIS STRIATULUS (Linne) Garman
(*Haldea striatula*, Baird & Girard)
GROUND-SNAKE, WORM-SNAKE

Type locality: Carolina.
General distribution: Virginia and Minnesota south to the Gulf States.
Alabama records: Mobile and Baldwin counties, common in low swampy fields.

GENUS: **THAMNOPHIS**, Fitzinger.

THAMNOPHIS SACKENII (Kennicott) Stejneger & Barbour
(*Eutaenia sackenii*, Kennicott)
OSTENSACKEN'S GARTER SNAKE, RIBBON SNAKE

Type locality: Florida.
General distribution: Florida to southern Mississippi.
Alabama records: Mobile County, lowlands.

THAMNOPHIS SAURITUS (Linne) Stejneger
(*Eutainia*, Baird & Girard)
RIBBON SNAKE

Type locality: Carolina.
General distribution: Michigan, Ontario, and Maine, south to Mississippi, Alabama and Georgia
Alabama records: Talladega, Tuscaloosa, and Barbour counties.

THAMNOPHIS SIRTALIS SIRTALIS (Linne) Garman
(*Eutainia*, Baird & Girard)
COMMON GARTER SNAKE

Type locality: Canada.
General distribution: Eastern North America.
Alabama records: Etowah, Shelby, Tuscaloosa, Greene, Mobile and Baldwin Counties.

In Mobile County only the color variety passing under the name *T. sirtalis ordinatus* is found, and this is very common there. This form is also found in Tuscaloosa County.

GENUS: TANTILLA, Baird and Girard.

TANTILLA CORONATA Baird & Girard
CROWNED TANTILLA

Type locality: Kemper County, Mississippi.
General distribution: Southeastern United States.
Alabama records: Mobile and Baldwin Counties.

This species belongs to the so-called *Opisthoglyph* snakes, a division of mildly poisonous snakes with grooved fangs in the rear of the upper jaw, but the species is so small as to be absolutely harmless to man.

FAMILY: ELAPIDAE

GENUS: MICRURUS, Wagler.

MICRURUS FULVIUS (Linne) Stejneger & Barbour
(*Elaps fulvius*, Fitzinger)
CORAL-SNAKE

Type locality: Carolina.
General distribution: South Carolina and Mississippi to Florida, the Gulf States, Mexico and Central America.
Alabama records: Etowah County (van Aller) Greene County (Cope), Tuscaloosa County, Mobile County, Baldwin County (Capt. Bowen).

Recent observations have demonstrated the fact, that this beautiful and innocent-looking serpent really must be considered dangerously poisonous, and care must be taken not to mistake it for our harmless Kingsnake, *Lampropeltis elapsoides*, which in outward appearance it greatly resembles. The two may be distinguished by the rule mentioned under the directions for collecting and preserving.

During my two years' stay in Nicaragua, I often handled Coral-snakes in spite of continuous warnings of the natives, but never had any of these snakes even at-

tempt to bite me. I shudder now at the chances I took solely upon the authority of "Brehm's Thierleben" in which work this snake is said to be harmless to man.†

FAMILY: CROTALIDAE*

GENUS: AGKISTRODON, Beauvois. (Should have been Ancistrodon.)

AGKISTRODON MOKASEN Beauvois
(*Ancistrodon contortrix*, Baird)
COPPERHEAD

Type locality: America.

General distribution: Massachusetts southward to Northern Florida, westward to Illinois, Arkansas and Texas.

Alabama records: Walker, Jefferson, Shelby, Bibb, Tuscaloosa Counties, and Mt. Vernon, Mobile County.

AGKISTRODON PISCIVORUS (Lacepede) Cope
COTTON-MOUTH MOCCASIN, WATER MOCCASIN, STUMP-TAIL MOCCASIN

Type locality: Carolina.

General distribution: Virginia to Florida and the Gulf States.

Alabama records: Tuscaloosa, Montgomery, Barbour, Mobile, and Baldwin counties.

This is the most common poisonous snake in the coast counties.

GENUS: SISTRURUS, Garman.

SISTRURUS CATENATUS CATENATUS (Rafinesque)
Garman
MASSASAUGA

Type locality: Prairies of the upper Missouri.

General distribution: Western New York, through Ohio to Nebraska, northward into Michigan and Ontario, southward to Kansas and Alabama.

Alabama records: Only one record of this snake from the State has come to my notice, the specimen was cap-

†See Proc. U. S. Nat. Mus. 17:334, 1895.

*All of the species belonging to this family are poisonous.

tured by Mr. Herbert H. Smith at Pratt's Ferry, Bibb County, and is preserved in the Alabama Museum of Natural History.

SISTRURUS MILIARIUS (Linne) Garman
GROUND RATTLER

Type locality: Carolina.

General distribution: North Carolina to Florida, Westward to Oklahoma and Texas.

Alabama records: University, Tuscaloosa County; Dothan, Houston County; Mobile and Baldwin Counties; not uncommon on cut-over pine lands.

GENUS: CROTALUS, Linne.

CROTALUS ADAMANTEUS Beauvois
DIAMOND-BACK RATTLER

Type locality: United States.

General distribution: Southern North Carolina to Florida, westward to Louisiana and Arkansas.

Alabama records: Mobile and Baldwin Counties; of rare occurrence.

During my twenty-five years of residence in Mobile I have spent hundreds of days tramping the woods in company with my friend, Mr. T. S. van Aller, covering practically every section of the county and I have seen only one specimen in its natural surroundings, and only about a dozen specimens have been noticed, dead, skinned or captured.

CROTALUS HORRIDUS Linne
TIMBER RATTLER, BANDED RATTLESNAKE, CHEVRON RATTLER
CANEBRAKE RATTLER

Type locality: America.

General distribution: Maine to Georgia, westward to the Great Plains.

Alabama records: Tuscaloosa County, Lock 15, Warrior River (Walter B. Jones, Nov. 1919), Pratt's Ferry, Bibb County (Herbert H. Smith), Greensboro, Hale County (Dr. W. C. Avery); Mobile County, two specimens have been seen and identified by the writer after having been skinned.

FAMILY: KINOSTERNIDAE

GENUS: KINOSTERNON, Spix. (Also spelled Cinosternum.)

KINOSTERNON CARINATUM (Gray) Stejneger & Barbour
(*Aromochelys carinata*, Gray; *A tristycha* Agassiz)
KEELED MUSK TURTLE

Type locality: Louisiana.

General distribution: Western Georgia to Louisiana.

Alabama records: Tuscaloosa and Talladega counties, Sepulga River, between Butler and Conecuh counties, Saraland, Mobile County (Hurter, as *K. tristychum.*)

KINOSTERNON ODORATUM (Latreille) Gray
(*Aromochelys* or *Sternothoerus odoratus*)
COMMON MUD TURTLE, STINK POT

Type locality: Carolina.

General distribution: Eastern and Southern United States, west to western Missouri and southern Texas.

Alabama records: Barbour County; Kelly's Pond, Mobile County.

KINOSTERNON SUBRUBRUM SUBRUBRUM (Lacepede)
(*Cinosternum pennsylvanicum*)
COMMON MUD TURTLE, STINK POT

Type locality: Pennsylvania

General distribution: Eastern United States, exclusive of peninsular Florida, west to Indiana, southeastern Illinois and Tennessee.

Alabama records: Barbour County, very common; Mobile and Baldwin counties.

KINOSTERNON SUBRUBRUM HIPPOCREPIS (Gray)
Stejneger & Barbour

Type locality: New Orleans, Louisiana.

General distribution: Southern Alabama to Southeastern Missouri and Texas.

Alabama records: None. Inserted on the authority of Stejneger and Barbour, who give the above range for it.

FAMILY: CHELYDRIDAE

GENUS: MACROCHELYS, Gray.

MACROCHELYS TEMMINCKII (Holbrook) Gray (*M. lacertina*)
ALLIGATOR SNAPPER

Type locality: Mississippi river and tributaries.

General distribution: Texas east to southeastern Georgia and northern Florida, north in the Mississippi basin to northern Missouri.

Alabama records: Mobile Bay.

GENUS: CHELYDRA, Schweigger.

CHELYDRA SERPENTINA (Linne) Schweigger
COMMON SNAPPING TURTLE

Type locality: "Warmer regions."

General distribution: Eastern North America.

Alabama records: Etowah, Tuscaloosa, Barbour and Mobile Counties.

GENUS: TERRAPENE, Merrem.

TERRAPENE CAROLINA CAROLINA (Linne) Bell
(*Cistudo carolina*)
COMMON BOX TURTLE

Type locality: Carolina.

General distribution: Eastern United States.

Alabama records: St. Clair, Tuscaloosa and Mobile counties.

TERRAPENE CAROLINA TRIUNGUIS (Agassiz)
Stejneger & Barbour (*Cistudo triunguis* Agassiz)
THREE-TOED BOX TURTLE

Type locality: New Orleans, Louisiana.

General distribution: Coastal Plain of the Gulf of Mexico, west into Oklahoma and southern Texas and north in the Mississippi Valley to Missouri.

Alabama records: None.

*I saw a small (presumably young) dead specimen of what is probably this species in the Tennessee River bottoms in Limestone County, opposite Decatur, April 18, 1922. R. M. H.

TERRAPENE MAJOR (Agassiz) Baur (*Cistudo major* Agassiz)
LARGE BOX TURTLE

Type locality: Mobile, Alabama; Florida.

General distribution: Florida, north into Georgia and west into southeastern Texas.

Alabama records: Mobile, numerous specimens (Loding).

Several specimens have been studied in which the characters of *Terrapene carolina carolina* and *Terrapene major* seem to converge.

This species is frequently used for food and makes an excellent dish.

GENUS: MALACLEMYS, Gray.

MALACLEMYS PILEATA PILEATA (Wied) W. P. Hay
(*Malacoclemmys palustris*)
DIAMOND-BACK TERRAPIN

Type locality: New Orleans, Louisiana.

General distribution: Coast from mouth of Mississippi River east to Florida.

Alabama records: Cedar Point, Coden and Bayou la Batre, Mobile County.

MALACLEMYS PILEATA LITTORALIS (W. P. Hay)
Stejneger & Barbour
DIAMOND-BACK TERRAPIN

Type locality: Rockport, Texas.

General distribution: Coast of Texas and outlying islands, and Alabama.

Alabama records: Cedar Point and Coden, Mobile County.

The Diamond-Back Terrapins are eagerly sought for by epicures, and bring a high price in northern and eastern markets.

GENUS: GRAPTEMYS, Agassiz.

GRAPTEMYS PSEUDOGEOGRAPHICA PSEUDOGEOGRAPHICA (Gray) Holbrook. (*Malacoclemmys lesueuri*)
MAP-TURTLE

Type locality: Wabash River, New Harmony, Indiana.

General distribution: Mississippi Valley, east to Alabama and Ohio, north to Wisconsin and northern Iowa; west to eastern Kansas and Oklahoma.

Alabama records: None.

GRAPTEMYS PSEUDOGEOGRAPHICA KOHNII (Baur)
Stejneger & Barbour
(*Malacoclemmys kohnii*, Baur, Science 16; 263, 1890)
KOHN'S TERRAPIN

Type locality: Bayou Lafourche, Bayou Teche, and St. Martinsville, Louisiana.

General distribution: Gulf strip from Pensacola to eastern Texas.

Alabama records: None.

GRAPTEMYS PSEUDOGEOGRAPHICA OCULIFERA (Baur)
Stejneger & Barbour.

Type locality: Mandeville, La.

General distribution: West Florida to southern Louisiana.

Alabama records: None.

GRAPTEMYS (MALACOCLEMMYS) PULCHRA, Baur
(*Am. Nat.* 27:675-676, 1893)

Type locality: Alabama River, near Montgomery (T. H. Bean).

This species is not recognized by Stejneger and Barbour in their Check List.

GENUS: PSEUDEMYS, Gray. (Cooters.)

PSEUDEMYS ALABAMENSIS (Baur)
(*Chrysemys Alabamensis*)
ALABAMA TERRAPIN

Type locality: Mobile Bay, Alabama.

General distribution: Gulf Coast from Florida to Louisiana.

Alabama records: Mobile Bay; Mississippi Sound.

PSEUDEMYS MOBILIENSIS (Holbrook)
(*Chrysemys mobiliensis*)
MOBILE TERRAPIN

Type locality: Mobile, Alabama.

General distribution: Southern portions of the Gulf States.

Alabama records: Mobile Bay.

Dr. Thomas Barbour of the Museum of Comparative Zoology, Cambridge, Mass., states that: "According to present usage Pseudemys mobiliensis is a synonym of Pseudemys concinna (LeConte)." (The recorded range for that species is from Maryland to Georgia.)

This and the preceding species are of much economic value to the State as a source of food supply."

PSEUDEMYS ELEGANS (Wied) Cope
(*Chrysemys elegans*)
CUMRERLAND TERRAPIN

Type locality: New Harmony, Indiana.

General distribution: Southern Texas and Mississippi basin north to Iowa, northern Indiana and Ohio.

Alabama records: Near Anniston, Calhoun County.

PSEUDEMYS HIEROGLYPHICA (Holbrook) Garman
(HIEROGLYPHIC TERRAPIN)

Type locality: Cumberland River, Tennessee.

General distribution: Ditmars in his Reptile Book gives Georgia, Alabama and Tennessee. The Stejneger-Barbour list gives the range as Rivers of Southern Appalachians.

Alabama records: The Alabama Museum of Natural History contains nine old specimens, presumably collected by Prof. Tuomey in the vicinity of Tuscaloosa about the middle of the last century.

GENUS: DIEROCHELYS, Agassiz.

DIEROCHELYS RETICULARIA (Latreille) Gray
(*Chrysemys reticulatus*)
CHICKEN TURTLE

Type locality: Carolina.

General distribution: Coastal Plain from Beaufort, North Carolina to central Florida and the Mississippi alluvial plain.

Alabama records: None.

GENUS: **GOPHERUS**, Rafinesque.

GOPHERUS POLYPHEMUS (Daudin) Stejneger
(*Testudo polyphemus*, Daudin)
GOPHER, LAND TURTLE

Type locality: Savanna and Altamaha Rivers, Georgia.

General distribution: Sandy, long-leaf pine forests from southern South Carolina to Florida and Texas, and perhaps north into southern Arkansas.

Alabama records: Around Grand Bay the Gopher is common on dry sandy banks covered with scrub oaks, it is typically terrestrial, and lives on fruits and herbage.*

FAMILY: CHELONIIDAE

GENUS: **CHELONIA**, Latreille.

CHELONIA MYDAS (Linne) Schweigger
GREEN SEA-TURTLE

Type locality: Ascension Islands, etc.

General distribution: Atlantic Ocean; Gulf of Mexico; occasionally as far north as Massachusetts.

Alabama records: Mobile Bay, and Mississippi Sound (J. A. Joullian).

GENUS: **ERETMOCHELYS**, Fitzinger.

ERETMOCHELYS IMBRICATA (Linne) Agassiz
(*Chelonia imbricata*)
HAWK'S-BILL TURTLE

Type locality: American seas.

General distribution: Similar to the preceding.

*It is sometimes eaten, especially by negroes, in West Florida, where it is much commoner than in Alabama. I have no definite recollection of seeing it in Alabama at all, or anywhere else west of Florida. For an interesting account of its habits see H. G. Hubbard in Science for August 4, 1893. R. M. H.

Alabama records: Included on the strength of the range given in the Stejneger-Barbour check list: "Florida and Gulf Coast."

GENUS: CARETTA, Rafinesque.

CARETTA KEMPII (Garman) Siebenrock
(*Thalasochelys* or *Lepidochelys kempii*)
KEMP'S LOGGERHEAD TURTLE, BASTARD TURTLE

Type locality: Gulf of Mexico.

General distribution: Northeastern part of Gulf of Mexico and north to Cape Hatteras, or occasionally to Massachusetts.

Alabama records: Mississippi Sound (J. A. Joullian).* All our sea turtles are much esteemed as food.

FAMILY: TRIONYCHIDAE

GENUS: AMYDA, Oken.

AMYDA FEROX (Schneider) Oken (*Platypeltis* or *Trionyx ferox*)
SOUTHERN SOFT-SHELL TURTLE

Type locality: Savannah River, Georgia.

General distribution: South Carolina to Florida and Louisiana.

Alabama records: One specimen from Fig Island, Mobile county. Occasionally reported from the Warrior River in Tuscaloosa County.

This turtle is edible.

AMYDA SPINIFERA (LeSueur) Hurter
SPINY SOFT-SHELLED TURTLE

Type locality: Wabash River, New Harmony, Ind.

General distribution: In rivers, Vermont and Pennsylvania to Montana and Colorado.

Alabama records: Tombigbee River near Demopolis (E. T. Norman, July 31, 1922).

*Loggerhead turtles are reported from the Warrior and Alabama Rivers by fishermen and others, but they can hardly be this marine species. Presumably the snapping turtle is mistaken for it, See Proc. U. S. Nat. Mus. 17:320, 1895. R. M. H.

SUMMARY

According to our present information the number of species and varieties of amphibians and reptiles known and to be expected in Alabama may be summed up by larger groups as follows:

		Certain	*Doubtful*	*Total*
Amphibians	Tailed Amphibians	21	6	27
	Toads and Frogs	19	3	22
Reptiles	Crocodiles and lizards	9	1	10
	Snakes	43	4	47
	Turtles	19	8	27
	Total	111	22	133

This is approximately the same number that have been recorded from other eastern states of about the same size, such as Virginia, North Carolina, Indiana, Missouri and Arkansas. Future exploration may be expected to transfer most of the doubtful species to the list of certain ones, and add others whose presence in Alabama is not now suspected, or distinguish forms not now regarded as distinct. As many of the counties in the state, particularly in the eastern half, have not been explored at all herpetologically, there is a great deal of work yet to be done. As an example of what may be done by thorough collecting, we have records of 89 species and subspecies from Mobile County, and 58 from Tuscaloosa County, and these figures probably do not exhaust the possibilities. Very likely at least half of the species known in the whole state could be found in any county.

COLLECTING AND PRESERVING OF REPTILES AND AMPHIBIANS FOR SCIENTIFIC AND MUSEUM PURPOSES

While scientifically the Reptiles and Amphibians may not be as closely related as has heretofore been conceded, yet the mode of collecting and preserving specimens is very similar, and for this reason may be treated under the same heading.

Unfortunately the average person seems to be inspired with fear and antipathy for these most useful and generally speaking harmless animals, adults and children alike consider it a religious duty, yes indeed! a heroic performance to kill at sight any animal that looks like a snake, not a thought do they give to the probability that such are placed in this world for some other purpose than to be a menace to human life.

There is, of course, the possibility, that many species may have outlived their usefulness and purpose, but the fact stands today that the great majority of these animals are performing a service to man that can not be replaced, and hardly over-estimated. In economic importance to agriculture and horticulture they may be classed equal to the birds and supplementing these in the task of keeping destructive insects and rodents within bounds. Nature adapted them to penetrate into underground nests and burrows and other places inaccessible to birds. It is unthinkable, that just the love of killing prompts the destruction of these harmless creatures, and nearly all such acts must be attributed to ignorance of the life and habits of these animals; in other words, to a lack of education.

The study of natural history in our public schools, has been much neglected, at least in the South. At best this study in a schoolroom does not interest the average child, but take him or her out into the fields and woods and show them nature alive, and the subject takes on an altogether different aspect.

To meet and get a speaking acquaintance with our reptiles and our toads, frogs and salamanders, we must know where and when to look for them.

In the winter and early spring months we find them usually in a semidormant state under logs and rocks, under bark of dead or dying trees, in the cavity of old rotten tree stumps, under moss, leaves and compost, and often deep in the ground; under such circumstances they fall an easy prey to the hunter. In the summer and fall we may find them in all of these places, but active and full of life. Most often at this time of the year we find them hunting their prey in the open field or forest undergrowth, in trees, or sunning themselves on a partly submerged log, on branches overhanging our rivers, creeks and lakes, or swimming in their waters.

Then, they are always on the alert, and often difficult to catch. All Amphibians, all of our Alabama lizards, and a large majority of our snakes can be taken and handled without the least danger of being bitten. Occasionally a black snake may draw blood as he gives you a nab in the finger, but it gives you no more inconvenience than the scratch of a thorn.

Salamanders and frogs we may have to fish for, using an earth-worm or a bit of red flannel as bait, quick running lizards may be shot with a parlor rifle using fine shot cartridges. Often one can use to advantage a fishing pole and line, with a slip-knot at the end to catch specimens which cannot be reached otherwise, stealthily slip the noose over his head, and a quick jerk will land him, this may be easier done if you can get the animal to concentrate its attention upon another person while you are slipping the line over its head.

A net is handy to catch water-snakes and Amphibians, and at times you may have to dig a specimen out of his hole. Altogether, the collecting of this class of animals calls for more strategy, and gives you more genuine sport and diversion, than most sportsmen get out of hunting and fishing, and it has the advantage that you preserve the specimen and can prove your snake story.

Before tackling any snake barehanded we should learn to know at sight our few poisonous ones. In Alabama we have only seven species to get acquainted with, six of these belong to the so-called pit-vipers and have identical

earmarks by which to recognize them: the broad square jaw and overlapping head shield which forms a pit at the side of the head between the eye and the snout. The seventh is our coral snake, a beautiful creature with red and black bands, separated by yellow rings.

The coloration of two of our harmless snakes so closely resemble this pattern, that a mistake is easily made; however, by observing the following rule you can never go wrong: in the coral or poisonous snake the red and black bands are separated by narrow yellow rings, and the snout is black; in the harmless snakes the red and yellow bands are separated by narrow black rings, and the snout is yellowish.

When hunting snakes with my old friend Hurter, I often saw him pick up moccasins and ground-rattlers by hand, he would grab them quickly by the end of the tail, lift them clear of the ground and drop them into his tin bucket. It may be comparatively safe to handle them this way; but I very much prefer the use of the snake pinchers. These I make out of two strips of sound ash wood about three feet long, one half to three quarter inch thick and an inch and a quarter wide. About four inches from one end I bore a hole and bolt the strips together loosely so as to make a pair of tongs similar to the longhandled tongs used by a blacksmith. A little notch cut on the inside of the four-inch ends will make a jaw to grasp and hold any snake around the neck.

On a collecting trip I always carry a few small but stout canvas bags in which to bring home the catch alive, preferably only one snake in each bag, but at times several of the same species may be put together in one bag. In the case of frogs and salamanders a sufficient supply of moist soil or moss must be enclosed with the specimens to keep them alive.

At the end of a day's collecting trip the catch must be killed, labeled and prepared for the preserving fluid.

One by one the specimens are removed from the collecting bags and killed by a hypodermic injection of from one teaspoonful to one ounce of 40 per cent Formaldehyde according to the size of the animal, for frogs, toads, and

salamanders use only one half this strength or a 20 per cent. solution. After the injection, which should be near the heart, drop them into a closed container, where they will be safe during the few minutes of death struggle.

When dead and before stiffened, inject them again with a weak or 4 per cent solution of formaldehyde and water in several places throughout the body, so that the solution may penetrate all parts and thus prevent decomposition. In the case of snakes an injection should be made in the tail, just behind the anal opening, this will bring out the genitals in male specimens and make them of more scientific value. The mouth of a poisonous snake is kept open and showing the fangs by the use of a small piece of carton or cotton inserted just behind the fangs between the upper and lower jaw. The specimen must now be labeled, writing with India ink on a Dennison label the name, date, locality, habitat, and name of collector, after which lay out the specimen in an attractive shape and form so as to fit the preserving jar and let it harden for about twelve hours, when it may be sealed up in a jar or vial filled with a solution of formaldehyde or grain alcohol. For the former solution use two ounces of 40 per cent. formaldehyde to each quart of water. When alcohol is used, it should be 75 per cent, grain alcohol for reptiles and 60 per cent. alcohol for amphibians.

Specimens should be looked over from time to time to see that they are covered with preserving fluid of the proper strength to keep them from decomposing.

IMPORTANT LITERATURE

It is beyond the scope of this report to include a bibliography; but for the guidance of prospective students it may be well to mention a few technical and popular text books in general use. Foremost among the former are the two National Museum Reports by Edward D. Cope, viz: "The Batrachia of North America", (Bulletin 34 of the U. S. National Museum 1889), and "The Crocodilians, Lizards and Snakes of North America", (Report

of U. S. National Museum for 1898). "Herpetology of Missouri" by Julius Hurter, (Transaction of the Academy of Science of St. Louis, 1911), contains good descriptions and very interesting accounts of the species found in that state.

Two of the most useful and captivating books on this subject may be found in the Nature Library published in 1907 by Doubleday, Page & Co., New York; one is entitled "The Reptile Book" by Raymond L. Ditmars, and the other "The Frog Book" by Miss Mary C. Dickerson. These two volumes give interesting and entertaining descriptions and beautiful plates, some colored, of nearly all Turtles, Crocodiles, Lizards, Snakes, Toads, and Frogs of the United States. A work almost indispensable to any student and collector is: "A Check List of North American Amphibians and Reptiles" by Leonhard Stejneger and Thomas Barbour, published by the Harvard University Press, Cambridge, Massachusetts, 1917.

On May 27, 1921, while paddling down the Locust Fork of the Warrior River with two companions, we saw one of these snakes swimming across the river near Sayre, Jefferson County. One of my companions killed it before we realized that it was this harm-species. R. M. HARPER.

ERRATA.

Page 5. For Lingusta (suborder) read Linguata.

Page 27. For footnote relating to *Heterodon contortrix* see page 53.

Page 42. The footnote on this page refers to *Chelydra serpentina.*

Page 46. Under *Gopherus polyphemus,* after Alabama records insert: Dog River and Grand Bay, Mobile County.

Page 53. The note on this page is a footnote relating to *Heterodon contortrix,* accidentally omitted from page 27. In the last line the last syllable of harmless was left out by the printers.

INDEX

Species are not indexed separately, for all those belonging to a given genus are listed on consecutive pages of the text, usually not more than two pages to a genus. Technical names of families and genera (both accepted names and synonyms) are printed in italics, and common names of species enclosed in quotations.

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GEOLOGICAL SURVEY OF ALABAMA

EUGENE ALLEN SMITH, State Geologist

MUSEUM PAPER No. 6

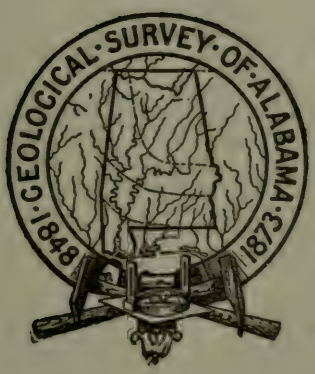
Alabama Museum of Natural History

The Anculosae of the Alabama River Drainage

BY

CALVIN GOODRICH

Published in Co-operation with the Museum of Zoology, University of Michigan.



1922

EXPLANATORY NOTE.

In the fall of 1904, Mr. Herbert H. Smith began systematic collecting of the fresh-water shells of the family Pleuroceridae of the Coosa River and its tributaries, for a syndicate of four naturalists: Hon. Truman H. Aldrich of Birmingham, Mr. George H. Clapp of Pittsburgh, Dr. Henry A. Pilsbry of the Philadelphia Academy of Sciences, and Mr. Bryant Walker of Detroit. Later Mr. John B. Henderson, of Washington, took Dr. Pilsbry's place.

From the very beginning of the work Mr. Smith's fixed idea was to make as complete a collection of Pleuroceridae as possible and—as customary with him—to study carefully as he collected; his notes show this.

Early in the fall of 1908, Mr. Smith came to the University at the request of Mr. Walker, to study the fresh-water shells of the Schowalter collection in the Museum of the Geological Survey of Alabama (as it was then known) and, shortly afterward, accepted a position as Curator of the Museum. From that time until his death (March 22, 1919) he retained this position, devoting much of his time to study of the Pleuroceridae.

The working up of groups was divided between Mr. Walker, who took the Unionidae and families of fresh-water shells other than the Pleuroceridae; Dr. Pilsbry, the Pleuroceridae; and Mr. Clapp the land shells. Pressure of other work soon caused Dr. Pilsbry to drop out and Mr. Smith took over the Pleuroceridae.

He had been working a long time on the genus *Anculosa* preparatory to monographing it, but this work was cut short by his death.

At the suggestion of Dr. Walker, our specimens of *Anculosa,* with Mr. Smith's notes, were turned over to Mr. Calvin Goodrich of Detroit, who was making a study of this group. The results of Mr. Goodrich's painstaking investigations appear in this pamphlet (based almost entirely on Mr. Smith's field work). In speaking of his own work Mr. Smith often said: "If I never monograph them myself, at least I will make it easier for my successor."

In 1920 (writing of Mr. Goodrich's pamphlet) Dr. Walker said: "It is a very fine piece of work and will make an excellent monument for the work that Mr. Smith did in Alabama."

The Geological Survey of Alabama had hoped to publish this monograph as one of a series of technical papers dealing with various groups of animals (others on birds, amphibians and reptiles having been published recently), but lack of funds has prevented. Owing, however, to Dr. Walker's kind offices, the University of Michigan has published it (Museum of Zoology Miscellaneous Publications No. 7), without expense to the Survey, except for the paper, press work and covers of 500 copies which were printed as an edition to bear our own cover and to be distributed by us.

Our sincere thanks are due to the University of Michigan for its friendly co-operation with the Geological Survey: to Dr. Walker for his kindly efforts to aid us in a time of need and to Mr. Calvin Goodrich for his generous appreciation of Mr. Smith's work and his unselfishness in effacing himself as the describer of new species. It remains to add that Mr. Goodrich is at work on another genus of the Pleuroceridae, *Gyrotoma,* which will be duly published.

Unfortunately, the opportunities for studying these and other shells in the Coosa River, which has probably had the richest molluscan fauna of any stream in the world, (as stated on p. 7), may be at an end after a few years, on account of the flooding of the shoals by dams for navigation and power.

For about 30 years past there have been four locks and dams for navigation on the river in the Paleozoic region, between Greensport and Riverside. A seventy-foot dam for power purposes was built in the region of the crystalline schists in 1914, backing the water for many miles, and another large dam just below (at Duncan's Riffle) is now nearing completion.

November, 1922. EUGENE A. SMITH.

UNIVERSITY OF MICHIGAN

MUSEUM OF ZOOLOGY

Miscellaneous Publications No. 7

The Anculosae of the Alabama River Drainage

BY

CALVIN GOODRICH

Published in Co-operation with the Geological Survey of Alabama

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The publications of the Museum of Zoology, University of Michigan, consist of two series—the Occasional Papers and the Miscellaneous Publications. Both series were founded by Dr. Bryant Walker, Mr. Bradshaw H. Swales and Dr. W. W. Newcomb.

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The Miscellaneous Publications include papers on field and museum technique, monographic studies and other papers not within the scope of the Occasional Papers. The papers are published separately, and, as it is not intended that they shall be grouped into volumes, each number has a title page and table of contents.

Alexander G. Ruthven,
Director of the Museum of Zoology,
University of Michigan.

THE ANCULOSAE OF THE ALABAMA RIVER DRAINAGE

By Calvin Goodrich

This study deals with a collection of Anculosae made by Mr. Herbert H. Smith within the drainage of the Alabama River between the years 1901 and 1918 for the Alabama Geological Survey. The new species, with one exception, were named by him. The classification follows that which he had in mind. After a year's examination of the collection, the writer feels toward Mr. Smith only the greatest respect for his industry in the field and the keenness of his observations. It was Mr. Smith's intention to prepare this paper himself. Death directed otherwise. His life spared, errors which possibly have crept into this paper would most certainly have been avoided.

The Anculosae vary exceedingly. They give the student the impression of an adaptive family that is constantly struggling with an altering environment. They are recommended to the scientist particularly as objects for tracing the geographical distribution of life in middle North America. I believe them to be no less valuable in this regard than the mammals, the crayfishes and the Naiades.

For help with this paper, the writer is indebted to Mrs. Daisy Smith, of the Alabama Museum of Natural History, who supplied a great deal of information about her husband's work and performed most of the thankless labor connected with handling the collection; to Miss Mina Winslow for the illustrations of the shells; to Dr. Bryant Walker for unwearying counsel.

The Group and its Environment

The Anculosae of the Alabama River system represent a distinct section of the genus. No species of Anculosa within the drainage occurs also outside of it. No species which is spoken of as an Atlantic, Ohio, a Cumberland or Tennessee form occurs within it.

The existence of this faunal cleavage was not suspected or was not believed in by Lea, Tryon and some of the other naturalists of their times. Lewis was convinced of it and laid emphasis on the fact as he glimpsed it. So far as can be learned from the literature his remarks passed unnoticed. It has remained, after many years, for Mr. Smith to demonstrate through his collections and studies that the dispersal of the Anculosae, however general it has been within the area of their habitat, has kept separate completely two main lines of development. This is the more remarkable because there has been an interchange of stream flow through piracy between the Tennessee tributaries and the Conasauga, and opportunities for the transfer of species, other than by means of stream capture, must have occured repeatedly farther to the west. A glance at the map will show that Wills Creek and Little River of the Coosa today very nearly touch Lookout Creek of the Tennessee. The latter is known to be inhabited by a typi-

cal Tennessee Anculosa. Branches of Black Warrior River, belonging to the Alabama system, and Flint Creek of the Tennessee, both having Anculosae, come within a little distance of each other. If the means of dispersal such as carriage by birds, mammals, wind, tornadoes and such floods as on a plateau bring streams of different drainage systems together—if such means were operative in the case of the Anculosae the forms of the Alabama and Tennessee rivers would long since have mingled. This study has made plain that intermingling has not taken place in recent geological time.

The manner of life of the Anculosae has undoubtedly had a great deal to do with restricting the means of distribution. I have not visited the Alabama streams and therefore cannot say with exactness just what are the habits of the genus there. It may be supposed, though, that these habits do not differ appreciably from those of the Anculosae of the Tennessee and Ohio systems. In the Clinch and Powell rivers of the Tennessee, the Anculosae are found on stones usually far from the shores and in the strongest current. The same thing is true of the two species at the Falls of the Ohio. After spring floods a fine coating of silt is left on the stones and in this medium the fresh water animal life leaves the chronicle of its movements as plainly as the marks of a pen upon paper Now while Pleurocera and Goniobasis are seen, for mollusks, to move about fairly actively, Anculosa moves scarcely at all. It seems to be content to find a place in the heavy current and to stay there, changing its position little except when change of water level or accident compels it.

There is not sufficient mud in such locations to serve as a carrier for mollusks on the legs of birds even if the mud present were of the kind to serve that end, which it isn't. As the eggs are laid in the same enviroment, being probably glued to stone surfaces, they too would be little likely to be carried away by birds. If the animal falls and is swept into still water the chances are against its surviving. Logs that might carry Anculosae down stream would come to rest as a rule in the quiet water rather than upon stones in swift water, and falling from such carriers must mean generally that the Anculosae perish. In the light of the record, the chances of such animals changing their habitat from one drainage into another when floods float logs across low land barriers seem exceedingly remote.

We must understand the dispersal of these creatures to be very slow, very restricted as to means and as being governed very largely by changes in the character of a stream—advantageous situations for the life of Anculosae arising and disappearing only over great periods of time.

The variability of the Pleuroceridae is notorious. Because of this, probably more than for any other one thing, the family has been neglected. Almost everyone who has had anything to do with it has hoped that as collecting became more extensive so many connecting links would be found that the number of species now recorded might be greatly reduced. Almost everyone has tried to avoid adding to the catalogue. One student, bold perhaps but more likely just impatient, did undertake a prodigious labor of lumping and he brought the number of species down to a meager dozen or so—deriving in the end, it must be feared, very little satisfaction for himself and certainly advancing the knowledge of systematic zoology not a

particle (Hannibal, 1912). As Mr. Smith saw it, and as I see it myself now, the undesirable conclusion is forced on one that there are far more existing species than have been described, that it may be a very long time before the last one has been found and the books closed.

The reason lies in the manner of life of the Pleuroceridae for one thing and for another in the apparent fact that the family is in the active ferment of evolution. The greater number of the species, in other genera as well as the Anculosae, inhabit rocks and gravel bars in swift-moving streams. The migrating impulse is absent. Observation leads to the conviction that in the case of a species of the Anculosa, as already mentioned, every moment of living may be spent upon a single spot of a single stone. Not only do the ordinarily recognized barriers restrict the spread of the animals, but the deep water of a river turns back creek forms, the deep water between bars in the same stream interrupts dispersal, in instances quite narrow rifts on a single group of shoals serve as effectual barriers.

The influences of isolation working from without thus exercise their greatest powers. Working from within the forces of evolution carry on differentiation still farther.

Speaking of one group of this family, Dr. Lewis (1873) made the despairing remark: "One cannot tell where to assign limits. Limits are apparently obliterated and species have no existence. They are a confused mass and must be referred to one type." I believe it is true that species in this family, except occasionally, do not exist as Dr. Lewis and his contemporaries wished to define the word species. One is lost who tries to think of these animals as having any such fixity of characters as occur in other families and orders. We have rather to think of the characters as overlapping from one race to another, even from genus to genus. That collection of individuals in the Pleuroceridae may be called a species whose predominant characters are not the predominant characters of another collection of individuals. If we see only a few specimens of a single species its own peculiar characters may often seem to be submerged by characters linking it with another species. But in a long series the individual characters stand out, and we are compelled then to recognize the existence of definable differences and to proceed to describe them and provide the label of a name. If we adopt the policy—the tempting course—of referring all these many collections to one or several types we surrender whatever value there is in the defining of local races and lose with it the means of tracing geographical distribution. Dr. Lewis' "confused mass" would become more confused than ever. All the tribes of American Indians—to go far afield for an analogy—are alike in certain regards, tribal characters overlap tribal characters, yet it is possible to differentiate tribe from tribe, and the right and necessity of the scientist and historian to speak of these collections of individuals as separate, distinct, differentiated, are not to be questioned.

With the method of evolution in this family, the writer is incompetent to deal. There has been so far no intensive study of the anatomy, no broad inquiry into the rules or rhythm of variation if any such things exist, no breeding and interbreeding to discover whether known rules of heredity apply here. It is a field still fallow for the experimenter.

THE GEOLOGICAL PROBLEM

In Cretaceous times, Georgia from Columbus northward and part of eastern and northern Alabama constituted a peneplain. The line westward from Columbus, Georgia, to Wetumpka and thence northwest through Centerville, Tuscaloosa and Fayetteville was the shore of the gulf which stretched as far as Cairo, Illinois, covered the western thirds of Tennessee and Kentucky, the greater part of Mississippi, part of Arkansas and the whole of what is now Louisiana. A stream of which the Coosa is now an existing part rose south or southeast of Chattanooga and emptied into the sea at or close to Wetumpka.

C. C. Adams describes the streams of the era in this region as in a condition of fine balance. In such a condition slight crustal changes might have brought about profound changes in stream course, diverting and rediverting flow, lending force to extensive piracies. A differentiated fauna necessarily experienced alterations with these changes. Parts of it were possibly left isolated, to retain characteristics, to intensify them or to lose them—all within itself. Other parts possibly suffered through competition or else interbred with forms of life with which hitherto they had not been in contact.

M. R. Campbell and C. W. Hayes, in 1894 and 1895, put forth the contention that as late as Tertiary times a river comprising the upper Tennessee and the Coosa flowed continuosly southward to the sea, and that—at some period in the Tertiary—a confluent of the Tennessee and one of the Sequatchie to the west formed a connection through Walden Ridge at Chattanooga and diverted the Tennessee section of the river into an entirely new course. D. W. Johnson reviewed this work ten years later. From studies upon the ground he came to a very decisive opinion that the "Tennessee River acquired its present course across the mountains some time before the close of the Cretaceous period when the present flat top of the mountains was continuous with the rest of the Cretaceous peneplain." To this view C. C. Adams was apparently won.

The theory of a Coosa-Tennessee River is not necessary to account for the dispersal of the Anculosae. Nor is it needed to explain the existing differentiation. A stream balance prevailing upon the Cretaceous peneplain such as Adams describes would permit of innumerable captures of tributaries and the transfer and dispersal of their molluscan species. Further there have been opportunities possibly in fairly recent times, geologically speaking, for an interchange of the fauna through stream piracy both to the east and the west of the mountains. Forms of Pleuroceridae in the Hiwassee, highly suggestive of Georgian forms, seem to point to captures by that stream from the Conasauga of the Coosa, the confinement of these forms to the Hiwassee and its vicinity pointing to a time of capture so recent that wide dispersal has not yet come about. There is reason, indeed, to believe that not only did the Hiwassee make captures from the Conasauga but that this latter stream also acquired tributaries which originally belonged to the present Tennessee confluent.

We are to imagine the Cahaba as a small stream in the Cretaceous times, flowing directly to the sea. The Black Warrior existed, if at all, either

as an extension of the Sequatchie River or as a small stream that now is a northern branch of the river. A question may be raised as to whether the valley containing both the Sequatchie and this northern reach of the Black Warrior ever was occupied by a single stream flowing its full length. It may be that in the Cretaceous the Tombigbee was not in existence at all. In every liklihood the Anculosae reached the three streams, Cahaba, Black Warrior and Tombigbee, from the Coosa River after the elevation of the continent and the linking of all these rivers with the Alabama.

CHARACTER OF ALABAMA STREAMS

The Coosa is said to have the most diversified molluscan life of any stream in the world. It has long been a classical collecting stream. Yet not until Mr. Smith undertook the labor was the collecting carried out in any systematic way. Concerning the reasons for the extensive animal population, Mr. Smith—so far as I can discover—has ventured to say nothing. But of the character of the Coosa and other Alabama streams, there occur many illuminating passages in his correspondence with Dr. Walker. Some of these are here printed in their chronological order.

From Wetumpka, he wrote toward the end of 1901:

"There is an island half a mile up the river, and we tried vainly to reach it for a long time, the water was too deep and swift. After awhile I managed to get a boat, and since then most of my collecting has been on the island. It is rocky and intersected by a number of small water channels, with numerous back-water pools. This island has turned out an astonishing number of species. Many of the forms are extremely rare and local. One pool is crowded with small species, some not over one-half inch, and it is about the only place in which I have found small ones at all."

Writing from Gadsden in October, 1904, Mr. Smith said:

"From Rome to Gadsden we found a constant succession of shoals, either along the shores or forming islands in the river. I think that the river shells are substantially the same down to the mouth of the Chattooga River. At first I thought there was a gradual change, but I found that a recurrence of the same conditions brought the same species. Below the Chattooga there are few shoals for ten or twelve miles; then a succession of rock and shingle shoals clear down to Gadsden; and on these we found a good many forms not seen above. I think, however, that this is only because the fauna gets richer; most of the species seen above persist as far as Gadsden."

In November of the same year he was at Riverside, writing:

"The Coosa below Gadsden is at first like the upper reaches. At the upper end of Minnesota Bend there are limestone rocks and shoals. Following this is a long stretch, eight or ten miles, in which the river is broad and lake-like with muddy bottom and low shores. I should think such reaches would be a pretty effectual bar to the migration of rock loving

Pleuroceridae, either up or down. Following this stretch come Leoto or Whistlenaut shoals, the first of the rock shoals which characterize the middle Coosa. These are really reefs of rocks extending quite across the river or leaving only a narrow channel. The river makes a strong current wherever it can find a passage. Two miles farther down and probably connected by rocks on the river bottom are the extensive Ten Island shoals. The Pleuroceridae show the greatest changes as we descend, that is, the changes are more apparent. The assemblage (upper Coosa forms) is continued as far as Minnesota Bend. Here on the limestone rocks there is a sudden and marked change. There is another marked change at the reef just above Leoto Shoals; and after that one or two new forms come in at every shoal."

In a letter of June 6, 1907, Mr. Smith gives a brief picture of collecting on the Weduska shoals:

"We could wade out half a mile in the rapids, which in that place are simply a succession of ledges with flat rocks or gravel between, the water swift in places, but never strong enough to be dangerous. I used to carry a large bag, and generally this and my pockets were filled in half an hour, though hardly one specimen in ten was saved."

Back in Wetumpka in February, 1908, Mr. Smith wrote:

"All this stretch (Cedar Island to Higgin's Ferry, Chilton County) is full of shoals except between Higgin's Ferry and Duncan's Riffle, where the water is still and deep. The distribution is exceedingly interesting. In very swift water we had to cling to rocks with one hand while fishing with the other for stones; once I got a dowsing."

Returned to University from Anita, he wrote of the Cahaba River:

"The Cahaba physically is very different from the Coosa. It is essentially a river of the Paleozoic limestone region, flowing through a gorge, and generally deep. The shoals, where they do occur, have deep water above and below. Stretches of deep water separate species of the Coosa, and apparently this is so of the Cahaba too."

Mr. Smith returned to the Middle Coosa in the summer of 1914. He says of Fort William shoals:

"Several reefs of rock cross the river diagonally, and on them we made our best hauls. It was exciting sometimes even for an old campaigner. There was one little pool under a fall which must have yielded over one hundred Gyrotomas. You would have laughed to see me sitting in the fall, holding on with one hand while I groped with the other, bringing up three or four every time; often they were washed out of my fingers, for the current was a caution. We worked until the last possible moment. When we left Fort William Shoals were entirely covered by the backwater of the power dam."

The Opercula

The literature is singularly unhelpful regarding the opercula of the Pleuroceridae. After the first superficial examination, the earlier naturalists took it for granted, or they seem to have, that little or no variation existed in this character. Throughout the four hundred and more pages of Tryon's Monograph of the Strepomatidae (1873) are just two items in the text and two illustrations, one of them entirely unreferred to, which give any indication of a recognition of differences. Dr. W. D. Hartman (1871) mentioned the serrated operculum of *Anculosa foremani* Lea and the ribbon-like opercula of some specimens of *Leptoxis rubiginosa* Lea. Yet he generalizes about the operculum as if he were convinced that these two variants were but rare exceptions to a rule most firmly fixed. So keen an observer as Lewis apparently felt that the opercula were not worth the bother of examination though he was unorthodox toward the accepted facts of his day relating to species and their relationships. Not until Pilsbry, in describing *Goniobasis comalensis* (1906), pointed out a distinctive form of operculum did anyone hint that the organ might vary sufficiently to warrant intensive study.

From the beginning of his work in Alabama, Mr. Smith made a point of observing opercula. From his correspondence one gathers the information that he found them exceedingly helpful in separating puzzling forms of the family. In one instance, where the nodose Goniobases (Eurycaelon) and nodose Gyrotomae appear together in the Coosa River, the operculum constituted a definite demarkation of generic character more conspicious than a rudimentary Gyrotomic fissure. He had other experiences of the sort among species of Goniobasis in the Cahaba River. The two Anculosae, *formosa* and *foremani,* run very closely together in certain localities. The opercula permit immediate separation without uncertainty.

On December 6, 1905, Mr. Smith wrote to Dr. Walker: "*Goniobasis showalterii* Lea, as you know, has the operculum greatly prolonged. The species is common on some parts of Weduska, Peckerwood and Fort William shoals, and I noticed that when the snail has its foot out, the operculum curls over the body, lying on it very neatly. I have found the operculum of great service in separating species of Goniobasis, but it is necessary to use great care. No part of the mollusk is so subject to accidents and distortion as is the operculum. In fact I am practically sure some Pleuroceridae as well as Campeloma and Tulotoma may lose the operculum altogether and form another. I have found living and apparently healthy specimens without operculum, and I have found others with a tiny and almost transparent new-formed operculum in place of the normal large one."

The operculum sharply differentiates the species of the *picta* group from one another and also from all the other groups. This is true as well in regard to the line between *A. ligata* and other Anculosae. In the *compacta* group, the line is cleanly drawn as against other groups, but probably only the student of the genus would readily distinguish the variations of the opercula of the three species belonging to it. There is, on the other hand, a great deal of similarity among the opercula of the *taeniata, ampla* and *showalterii* groups, and this supports to some extent certain general similar-

ities in shell characters. In *A. flexuosa* H. H. Smith there are likenesses of shell which link the species both with the *picta* and the *taeniata* group. There is likewise a dimorphism of opercula.

In the *picta* group we have the largest opercula of the genus. They are all easily recognizable and separable apart from their shells, the spiral lines are usually well marked, there is a similarity of color and texture as there is a similarity in the fact that all have loosely-coiled whorls. The opercula of *picta* and *formosa* are alike in form, but the latter are large and the spiral lines are more clearly defined. From the Conasauga down to Cedar Bluff on the Coosa, the operculum of *dowiei* is more individual than it is farther south where it tends to mirror the operculum of *formosa*. As in the case of the shell, the operculum of *modesta* seems to be a degenerate form of *dowiei*. The *foremani* operculum has the distinctive serrations first noticed by Hartman. It is inclined in many instances to be definitely triangular. Though in point of shell characters this species is closer to *formosa* than is *dowiei*, the operculum yet points to a more distant relationship. Mr. Smith was at one time inclined to believe that his *clipeata* deserved erection as the type of a new genus upon the basis of the operculum, which is large, thick-margined, generally very dark and with the strong spiral lines near the center. It would seem that his opinion changed in this matter. The operculum of *clipeata* is carried at the very opening of the aperture, much as in the case of *Bythinia tentaculata* L.

The opercula of the *taeniata* group have tightly-coiled spiral lines, usually very indistinct. They are ovate to elliptical, ordinarily dark. In *taeniata* the opercula of young and half-grown specimens are usually elongate, but as the animal grows older it widens the organ. Those of *torrefacta* though generally rougher resemble the opercula of *taeniata* just as the shells are much alike. In *coosaensis*, the opercula are smaller, more regularly formed and less variable than in *taeniata*. The normal operculum of *griffithiana* is thick, dark, broader in proportion to altitude than in *taeniata*, the growth lines strong. The ribbon-like operculum which occurs in many specimens is a variant developing with the juveniles and there are no indications that it is brought about through accident or disease. The spiral lines and the nucleus are absent. Growth proceeds from the left margin, or that nearest the columella, along a straight line, turning outward slightly at the edges. As the ordinary operculum resembles a leaf, so in this kind of operculum the grain of a tree is suggested. Hartman (1871) was under the impression that such opercula occured among individuals inhabiting still water. Mr. Smith found it in *griffithiana* in numbers on the Coosa shoals. In *aldrichi* we find opercula of the normal and the produced form common to *griffithiana*, though much smaller. In *choccoloccoensis*, the operculum is shaped like that of *taeniata*, but the spiral lines are more loosely coiled. The operculum of *brevispira* is narrow, elliptical in the young, developing the characteristic *taeniata* form not until well grown. It may be described as the antithesis of the operculum of *clipeata*, for it occupies only one-third to one-half of the aperture, and when withdrawn must go far within the shell.

In the *ampla* group, the opercula are not easily to be distinguished from

those of the preceding group, and doubtless the affinities between the two groups is in general quite close. They have the closely-coiled inner whorls of the *taeniata* assemblage, are ovate to elongate, dark as a rule. In seeking an operculum of *ampla* to illustrate, none could be found among the river specimens which had any remaining traces of the spiral lines. The figure pictured is the operculum of a creek shell. Damaged and distorted opercula are the rule in this group. The *ampla* operculum is usually narrower in proportion to altitude than others of the group. In *mimica* the broad operculum illustrated is not wholly characteristic, elongate forms also appearing. The opercula of *plicata* are in general ovate, the growth lines frequent and strongly-marked. Those of *smithi* are closely related to the opercula of *plicata*.

No common characteristic is observable among the opercula of the *showalterii* group. *Showalterii* itself has a distinctive operculum, elliptical, dark, the margins of adult specimens thickened. The striking feature of the operculum of *sulcata* is the loosely-coiled spiral lines. Neither of these opercula does the operculum of *lirata* resemble, though in a longer series than has been at hand the connection might be made more clear. The operculum of *occultata* is like that of a small *sulcata*.

The opercula of the *compacta* group are small, thin, with tightly-coiled spiral lines when they appear at all. The organ to a large extent seems degenerate. The operculum of *compacta* which is illustrated has four whorls. This is probably an abnormality. The fan-like development of *melanoides* is characteristic also of the operculum of *vittata*.

The operculum of *ligata* is described in detail later on. There exists no close affinity to this form among the other Anculosae, nor is any relationship traceable to any kind of operculum so far discovered outside of the genus.

CLASSIFICATION

The Anculosae of the Alabama drainage divide into six groups, four of them well defined, two others which are not so distinctive and might prove upon more thorough study, particularly of the anatomy, to belong to one of the groups whose border lines are of satisfying clearness.

The *picta* group consists of six members, characterized by a similarity of shell structure and, to some extent, of opercula. Taking *picta* as the head of the group, not because it appears to be the most primitive form, but because it is the oldest in point of christening, *clipeata* and *formosa* are seen then to be the nearest relatives, with *foremani* more distantly connected and in shell characters allied to *formosa*. *Downiei* can be fancied upon this family tree as the direct descendant of *formosa*, and *modesta* as the poor relation of *downiei*.

For a second group, *taeniata* has been taken as the leading term. The small and not very firmly established local race *torrefacta* is closely allied. Somewhat more distant is *coosaensis*, another local race, but which yet has acquired an unmistakable individuality and such prosperity as is indicated by large numbers. *Griffithiana* follows as a seemingly ancient offshoot. *Choccoloccoensis* would appear to be the descendant of *taeniata*, or of one of *taeniata's* antecedents, which invaded a tributary of the main

stream, becoming modified through isolation and the influences of creek conditions. *Brevispira* is still farther away from *taeniata,* presenting in part aspects common to *ampla* of another group and possessing a dimorphism peculiar to itself. *Aldrichi* I believe to be a derivative of *griffithiana* as also *flexuosa,* a puzzling form which supports the suspicion of hybridization more than any other species among the Alabama Anculosae.

The three members of the *compacta* group—*compacta, melanoides* and *vittata*—are small unsculptured mollusca, one living in Cahaba River, the second in the Black Warrior and the third in the Coosa. *Compacta* was recognized as a Lithasia by Tryon, but it is as truly an Anculosa as is *melanoides,* which it resembles. In shell characters the first two are alike, but as regards the opercula the affinities are closer between the second and third than between either of these and *compacta.*

Anthony's *ligata* constitutes a group to itself. It has no close relationships with any other living Anculosa and its operculum is unique.

The relationship of the members of the *ampla* group to one another is quite clear. *Mimica* is a creek form of *ampla,* confined to one stream so far as is known, which has become uniformly smaller, has intensified the parent sculpture and acquired a distinctive banding formula that involves more than 50 per cent of the collected shells. *Plicata* can be conceived as the living representative of emigrant *ampla* of long ago which went into the Black Warrior and the Tombigbee rivers. The small creek species *smithi* links with *plicata.* The whole group is compact, well characterized. Yet the gap between it and the *taeniata* group is vague. Conic forms of *ampla,* taken by themselves and lacking as they often do the flattened columella most strongly marked in juvenile and half-grown specimens, might easily be confused with *taeniata.* There is also a certain amount of resemblance in the opercula.

The *showalterii* group is less compact than the preceding one. Both *showalterii* and *sulcata* have smooth or nearly smooth forms, and seem then to belong to the *taeniata* group. Certain rather rare forms of *griffithiana* copy *lirata* and only because there exists a long gap in the river between the two races the species might justly be brought close together. The opercula are wanting in distinctiveness, resembling most those of the *taeniata* group. Yet the deeply sulcate character of the mass of these three species seems to warrant their separation into a group to themselves. They are besides common to one fairly short stretch of the Coosa River whereas the members of the *taeniata* clan are more widely scattered. *Occultata* is joined to this group on the ground of its *sulcata*-like operculum and the flaring peristome which is a well-marked feature of young *showalterii.* Mr. Smith also placed it here.

Known Distribution of Alabama Anculosae

PICTA GROUP

A. picta Conrad. Bars of Coosa River from below Wetumpka to Clairborne, Monroe County, on Alabama River.

A. formosa Lea. Coosa River, Minnesota Bend below Gadsden, Etowah County, to Wetumpka.

A. foremani Lea. Coosa River, Three Island Shoals, Talladega County, to Butting Ram Shoals, Coosa County.

A. clipeata H. H. Smith. Coosa River, below Riverside, St. Clair County, to Butting Ram Shoals.

A. downiei Lea. Conasauga River, Georgia, to about Riverside, on the Coosa.

A. modesta H. H. Smith. Coosa River, Cherokee and Etowah counties.

TAENIATA GROUP

A. taeniata Conrad. Coosa River, from northeastern corner St. Clair County, to Clairborne, Monroe County, Alabama River. Lower part of Cahaba River.

A. torrefacta H. H. Smith. Coosa River, Weduska Shoals.

A. coosaensis Lea. Coosa River, Fort William and Peckerwood shoals, Talladega County.

A. griffithiana Lea. Coosa River, The Bar, Chilton County, to Wetumpka.

A. aldrichi H. H. Smith. Coosa River, near mouth Yellowleaf Creek, Chilton County.

A. flexuosa H. H. Smith. Coosa River, Wetumpka.

A. choccoloccoensis H. H. Smith. Choccolocco Creek, Talladega County.

A. brevispira H. H. Smith. Coosa River, Three Island Shoals, Talladega County, to Higgin's Ferry, Chilton County.

AMPLA GROUP

A. ampla Anth. Cahaba River, upper reaches to mouth; Coosa River, Wetumpka; creeks of Calhoun, St. Clair, Talladega, Shelby, Chilton and Coosa counties, tributaries to the Coosa.

A. mimica H. H. Smith. Little Cahaba Creek, Bibb County.

A. plicata Conrad. Black Warrior and Tombigbee rivers.

A. smithi Goodrich. Valley Creek, Jefferson County.

SHOWALTERII GROUP

A. showalterii Lea. Coosa River, Fort William and Peckerwood shoals, Talladega County.

A. lirata H. H. Smith. Coosa River, Three Island and Fort William shoals, Talladega County.

A. sulcata H. H. Smith. Coosa River, Ten Island Shoals, St. Clair County to Peckerwood Shoals, Talladega County.

A. occultata H. H. Smith. Coosa River, The Bar, Chilton County, to Butting Ram Shoals, Coosa County.

COMPACTA GROUP

A. compacta Anth. Cahaba River and tributaries.

A. melanoides Conrad. Black Warrior River and possibly Alabama River.

A. vittata Lea. Coosa River, The Bar, Chilton County, to Wetumpka.

LIGATA GROUP

A. ligata Anth. Coosa River, Weduska Shoals, Shelby County, to Wetumpka.

Anculosa picta CONRAD

Figs. 6, 7

Anculosa picta Conrad, *Silliman's Journal*, Vol. ii, p. 342, pl. 1, fig. 15, Jan., 1934.
Anculosa zebra Anth., *Proc. Acad. Nat. Sci., Phil*, Feb., 1860, p. 69.

The species is described by Conrad from specimens he collected in the Alabama River at Clairborne, this material, according to Tryon, consisting of stunted or immature forms. Tryon probably had reference to a modification very common to the species in the Alabama River at Selma and less marked in the Coosa, occuring besides in at least one other member of this group. The normal *picta* is subglobose to conic, with areas almost flattened, having obscure nodules at the shoulders or in instances distinct nodules, the aperture large, ovate. In the case of the modification, the shell is decidedly narrow in relation to altitude, the whorl smooth and rounded, curiously compressed on the side close to the peristome, the aperture almost round.

The growth lines of *picta* are ordinarily fine, sometimes almost obliterated as if from the scouring by sand. Revolving striae are usually very faint and discontinuous, and often entirely absent. Folds, where they occur, are not very prominent. In one lot of Mr. Smith's own collecting from the Coosa at Wetumpka, 6 specimens had well-marked folds from suture to base, 3 had folds faint or nearly miscroscopic, 4 were without such markings; 6 had knobs or plicae at the shoulder, 7 were without such sculpture.

In color this species is usually a shining, light brown, varying to dark brown, sometimes greenish. The bands are fine, close-set lines of coloring matter, interrupted or continuous, varying in number from four or five to fifteen or sixteen. In several of the lots, the unbanded shells are equal in number to those with bands.

In half-grown specimens, the columella is strong, smoothly rounded, the deposit of callous at the top not particularly heavy. This character in old specimens shows a tendency to distortion; the columella becomes flattened on the outer edge and often is there eroded; the deposit of callous at the junction with the peristome is so large as to give an effect of buttressing peristome and columella. Of 27 shells in one lot from Wetumpka, the columella of all except one was white. A Cahaba River lot had 6 shells with white and 7 with reddish columella. White, purple and reddish columellae were noted in Alabama River shells. The peristome of *picta* is sharp-edged, firm, usually straight, sometimes curved near the suture.

The embryo shell is small, smooth, tightly coiled, the apex slightly raised. It consists of about one and one-half whorls. The adult *picta* may possibly acquire as many as six whorls.

The *zebra* forms of this species are unquestionably pathological. The coloring matter has been deposited in somewhat zigzag method longitudinally, four or five of these "blotches" occuring on the whorl. This irregularity in instances takes place in connection with the normal banding system. The abnormality has been noted in other species. Anthony's description and the remarks of Tryon lead to the assumption that *picta* was the shell before Anthony when he established the species *zebra*.

Measurements:

Altitude	*Diameter*			
19 mm.	11½ mm.	Coosa	River,	Wetumpka
18	11½	"	"	"
17½	12½	"	"	"
17	12½	"	"	"
18½	13	Cahaba	River	
18½	12	"	"	
17	12	"	"	
20½	13½	Alabama	River	
18½	12	"	"	
17½	11	"	"	
17½	11½	"	"	Selma
16½	10	"	"	"
15½	9½	"	"	"
13½	8¾	"	"	"
12	8	"	"	"

The operculum of *picta* is large, leaf-like, rather thin, reddish-brown, and consists of about three whorls. The left margin is thickened and usually straight, the apex acute, the right margin thin and frayed, the basal margin broadly rounded. The polar point is slightly sunken, the edges of the whorls within the operculum being sharply marked and raised though more so in some opercula than in others. The nucleus is well within the body of the operculum, slightly nearer the left than the right margin and situated about the lower third of the length. A "freak" operculum shows four well defined whorls. Growth lines are coarse.

Mr. Smith's Coosa River *picta* are labeled Wetumpka, but in a letter to Dr. Walker he has explained that the species was not taken in the true Wetumpka Shoals, but on gravel bars of the river below the town, a section geologically much younger. The other extreme of distribution, so far as known, is Clairborne.

Anculosa formosa Lea

Fig. 3

Anculosa formosa Lea, *Proc. Acad. Nat. Sci., Phila.*, 1860, p. 187; *Obs.* ix, p. 76, pl. 35, fig. 61.

Lea described specimens apparently of unusual rotundity and figured a juvenile individual. Tryon does not seem to have had access to a large

amount of material and was persuaded that Lea's *formosa* was synonymous with *A. ampla* Anth., a decision possibly justified under the circumstances. Mr. Smith was enabled to prove the specific identity of *formosa* from the shells in the Schowalter collection which did not come to the eyes of either Lea or Tryon. He himself collected a large series of these distinctive Anculosae. An adult from Fort William Shoals, Coosa River, is here described:

Shell: Conic, thick, Dresden brown, shining. It has ten or twelve low, broad, rather obscure folds from shoulder to base. At the shoulder are irregular nodules which in other shells often take the clear form of plicae. Microscopic lines of growth are fine; no revolving striae save the channels between the folds were observed. Suture impressed, irregular. Aperture ovate. A broad band appears at the top of the aperture and another at the base. Between these two bands are six or seven faint, interrupted fine lines of color such as occur in *A. picta* Con. Peristome sharp-edged, but firm; slightly curving near the suture. Columella porcelain white, very strong, curving regularly, rounded, flattened slightly on the outer edge, a heavy deposit of callous at the top, base unusually heavy. The shell is 19 mm. in altitude; diameter, 14¼ mm.; aperture, 8¾ mm. by 7. Collected by Herbert H. Smith, July, 1913.

The species first appears in the Coosa at Minnesota Bend, just below Gadsden. It has there many of the aspects of *A. downici* Lea which occurs in the same shoals, being yellow or light brown, strongly folded and with distinct plicae. There is a gradual modification of these characters proceeding down the river. At Ten Island Shoals the shells tend to lose the plicae, to acquire a strongly shouldered appearance and to be slightly ligulate. The middle and lower river form begins to show at Three Island Shoals in Talladega County, though occasional mollusks above this locality have the middle river aspect. At Fort William Shoals plicated specimens are rather rare, smooth shells are more common than in the shoals above. The lots from Weduska Shoals, The Bar, Butting Ram Shoals and Wetumpka are smooth, without folds or clearly marked plicae.

Variations as to locality in the matter of banding are also noticeable. Minnesota Bend shells have fine lines within the aperture, often nearly obsolete, which follow the folds of the outer surface. At Ten Island Shoals a single shell was found which has three well marked bands of the usual form, one above the periphery, two below it. More and more shells of this character appear as the collections progress down the river. In one of the lots from Fort William Shoals, 44 have the fine, broken lines typical of *picta* with the addition of a heavy band at the base; 19 have the lines continuous together with the basal band; 20 have an arrangement of four equidistant, clearly defined bands. Five modifications of this latter arrangement were noted in a total of 28 specimens. In one lot from The Bar, nearly as many specimens had a few definite bands as had the many fine lines of color. The two forms were of equal number in material from Butting Ram Shoals.

The prevailing color of the columella of the up-river *formosa* is white. In a Fort William Shoals lot 85 shells had a white columella, 26 had the

columella purple, 4 were of red and 1 black. Below Peckerwood Shoals, which are an extension of those of Fort William, purple becomes the prevailing color of the columella, with the exception that the *formosa* taken by Mr. White at Wetumpka had the columella white.

In this species there occur specimens with a ground color of red, showing most richly in the columella. One shell from Fort William Shoals is black throughout, or a very dark purple. Material of the *flammata* coloration appears in lots from Hall's Island, Talladega County, down.

The embryo shell of *formosa* is smooth, tightly coiled, the apex slightly elevated. It consists of one and one half to one and three-quarters whorls. Probably an adult specimen, if uneroded, would show six whorls.

Two lots of shells in the Alabama collection, four specimens in all, are labeled as from the Cahaba and Alabama rivers. It is to be suspected that these are cases of mislabeling. Mr. Smith's collecting justifies the belief that Wetumpka is the southernmost point of distribution.

The operculum is thin, wing-like, dark-red. Left margin firm, nearly straight and slightly bent backward at the acute apex; right margin broadly curved, very much torn; basal margin rounded. Growth wrinkles very coarse. The nucleus is located in the lower third of the operculum about 1 mm. from the left margin. Whorls three. Spiral lines raised, not always well defined or regular. The area of attachment is elliptical, narrow relative to the size of the operculum. The operculum of *formosa* shows a close affinity to that of *picta*.

Measurements of Shells:

Altitude	*Diameter*	
17½ mm.	13 mm.	Below Minnesota Bend, Etowah County
19	13	Ten Island Shoals, St. Clair County
17½	13½	" " " " " "
16	12	" " " " " "
16½	12	Lonigan Shoals, " " "
18½	12¾	Clarence Shoals, " " "
18	13	Fomby Shoals, " " "
20	13½	Truss Shoals, " " "
18	14	Hall's Island, Talladega County
21	14½	Three Island Shoals, Talladega County
19	12	" " " " "
24	14	Ft. William Shoals, " "
20	13	" " " " "
19½	13½	" " " " "
16	12	" " " " "
14	11½	" " " " "
19½	14	Peckerwood Shoals, " "
19	13	Weduska Shoals, Shelby County
19½	14	The Bar, Chilton County
18	12½	" " " "
20	14	Butting Ram Shoals, Coosa County
19	13¼	" " " " "
15½	12	Wetumpka, Elmore County

Anculosa foremani Lea

Fig. 4, 5

Anculosa foremani Lea, *Proc. Amer. Phil. Soc.*, ii, p. 243, Dec. 1842.

In shell characters this species is closer to *A. picta* Con. than is *A. formosa* Lea. But while the operculum of *picta* and *formosa* are much alike, that of *foremani* is like the operculum of neither. The similarity of the shells of *formosa* and *foremani*, *picta* out of consideration, varies strangely with locality, the resemblances and differences seeming to play a game of see-saw as the collector travels down the Coosa River. At Three Island Shoals, for example, *foremani* is a smaller, smoother mollusk than *formosa*, without the basal band so oddly persistent in that species. At Fort William Shoals the two forms come so closely together that, lacking the opercula for guidance, a large series is required to make identification certain. At Weduska Shoals, the differences become more distinct again, *foremani* retaining folds, *formosa* having lost them, the fine lines of color of one being faint, those of the other strong. Thus with each locality there are variations permitting separation of the two species, yet not always because of the same characters. In general, *formosa* is a larger species, more shining, with slightly heavier columella and a greater tendency as it proceeds downstream to substitute a few bands of color for the many fine lines. If the hypothesis is correct that the animal, protected and less subject to environmental forces, is less inclined to change than the exposed shell of the mollusk then, with the opercula in mind, we may suppose that *foremani* sprang from a form distinct from the ancestral forms of *picta* and *formosa*. We must explain the marked resemblances of the shell as a case of convergent development.

The sculpture of *foremani* consists of fine growth lines, microscopic revolving striae being rather rare. About half of the specimens of any given lot have broad, flat folds, more or less distinct and about the same number have nodules at the shoulder which may be termed plicae.

The fine lines of color are usually interrupted and at places there are shells which, like *formosa*, acquire a band at the base in addition, though usually this character is not as strongly marked, when it exists, as in the other species. Bands first appear in material from Fort William Shoals, the arrangement being four bands with a fine line of color between two of them. Such specimens are comparatively rare and among *foremani* are noted only from the locality given, Peckerwood Shoals and Butting Ram Shoals. Shells having the pathological character of *flammata* and *zebra* are not uncommon to this species.

The color of the columella varies from white to red and purple. The collections from Three Islands Shoals have the columella white in four shells in six; at Butting Ram Shoals, virtually the southernmost point of distribution, purple columellae were to the white in about the same proportion.

The operculum is reddish brown with the edges transparent. It is nearly triangular in most instances and very small in proportion to the size of the

aperture. Growth lines coarse. The left margin is nearly straight, the right margin curved and serrated regularly, the base broadly rounded, serrated. The nucleus is sunken, the spiral lines loosely coiled, whorls three. The serrations begin at about one and one-half whorls, and usually can be observed even after the horny material of the operculum fills the interstices between them.

Measurements of shells:

Altitude	*Diameter*	
19½ mm.	13 mm.	Three Island Shoals, Talladega County
18	11½	" " " " "
21½	14½	Fort William Shoals, " "
20½	13½	" " " " "
19	14	" " " " "
18	12	" " " " "
18	14	Peckerwood Shoals, " "
20	13½	Weduska Shoals, Shelby County
18½	11½	" " " "
18	13	The Bar, Chilton County
20½	13¾	Near mouth Yellowleaf Creek, Chilton County
19½	14	" " " " " "
17	12½	" " " " " "
20½	13	Butting Ram Shoals, Coosa County

The species is confined to the Coosa River, appearing first at Three Island Shoals and reaching the limit of its distribution at Wetumpka, Mr. Smith's collection of *foremani* at this locality consisting of just one specimen. Judging by the numbers collected, the shallows near the mouth of Yellowleaf Creek, Chilton County, are the most flourishing places in the river for this most interesting form.

Anculosa clipeata H. H. Smith, new species

Fig. 8

Shell: Conic, of moderate thickness, body whorl slightly flattened, the base rounded. Growth lines fine, tending to wear smooth below the periphery; crossed in places just below the suture by a few discontinuous, waving striae. Apex eroded. Suture impressed. Three or four low nodules appear on the shoulder, marking where growth has been made over the deposit of shell material at the top of columella. Aperture ovate, yellowish white. Peristome sharp-edged, firm, curving outward just below the suture, a little sinuous toward the base. Columella pearl-white, rounded, a little flattened on the outer edge near the center, heavy at the top. The ground color of the epidermis is raw sienna of the Ridgeway color standards, with twelve interrupted lines of dark coloring matter, these showing up very sharply within the aperture.

Operculum: Oval, thick, leathery, measuring 6 mm. by 3½ mm. Apex acute. Left margin not so curved as the right margin, this margin being thickened, smooth-edged. The basal margin is broadly rounded. The nucleus is very small, slightly sunken, located about 1½ mm. from the left margin and in the lowermost third of the operculum. Whorls three.

Measurements of shell: Altitude, 15½ mm.; diameter, 11¼ mm. Aperture—altitude, 6¼ mm.; diameter, 5 mm.

Type locality: Coosa River, Fort William Shoals, Talladega County, Alabama. Collected by Herbert H. Smith, June, 1914.

Type in the Museum of Zoology, University of Michigan; paratypes in that museum and the Alabama Museum of Natural History.

This species has two distinct geographical forms. From the first locality at which it has been found—between Riverside and Ogletree Island in St Clair County—to Peckerwood Shoals, Talladega County, the species has some of the general characteristics of the *picta* group, being bright in color, rounded at the base, rather smooth and usually having fine, interrupted lines in place of bands. At Weduska Shoals a decided change is observed. The shell here is medal bronze to olive green in color. The base is sub-angular. Growth lines are raised, often rough. The arrangement of bands, where bands occur, is four—interrupted or continuous. The shell suggests a small *A. taeniata* Con. While no specimen of this latter form appears to have been collected above Weduska Shoals, occasional specimens of the middle river form have been found from Weduska Shoals to Butting Ram Shoals, apparently the southernmost point of distribution.

The sculpture of *clipeata* varies slightly, some specimens having the folds which are more or less common in this group and others showing a tendency to develop obscure plicae. In a lot from Fort William Shoals, 29 individuals had folds upon the surface, 90 were without any and about one shell in fifteen had indications of plicae. Folds and plicae were both generally absent in collecting from Weduska Shoals downward. Of 117 shells of one lot from Fort William Shoals, 100 had the characteristic fine lines; 15 had bands, the arrangement being four or a modification of it; two were without lines or bands. A lot from The Bar, Chilton County, had sixteen shells with the four-band formula, the bands broken or continuous, with three modifications of this arrangement, represented by one specimen each. Three shells lacked any bands, and none had lines. From where *clipeata* is first found to Peckerwood Shoals, the collumella is white with only occasional shells wherein this character was red or salmon. In the lower river forms, the salmon or salmon-orange columella is common to about as many mollusks as the white columella.

The embryo shell consists of about one and one-half whorls, smooth, loosely coiled and virtually upon the same plane. The adult *clipeata*, if uneroded, would probably be found to have five whorls.

The outstanding feature of this species is the extraordinarily large operculum. In specimens in which the opercula have not been removed they are seen to overlap the columella slightly, touching the edge of the outer lip and occupying practically the whole space of the aperture. Probably in life the operculum is not withdrawn more than one or two millimeters. Some unimportant variations have been observed. At Peckerwood Shoals, the operculum of the adult shell is thin and amber-brown as in the young. The basal margin seldom seems to suffer from abrasion as it does in opercula of many other species. The area of attachment, elliptical in shape, occupies about one-half of the operculum. Frequently the spiral lines seemed to be as strongly developed on the inner side as on the outer.

Measurements of shells:

Altitude	*Diameter*	
16 mm.	11½ mm.	Three Island Shoals, Talladega County
15½	11½	" " " " "
14½	10	" " " " "
20	12	Fort William Shoals, " "
17	11¾	" " " " "
16½	12	" " " " "
15½	11	" " " " "
16¼	11	Peckerwood Shoals, " "
14½	10	Weduska Shoals, Shelby County.
16¼	10¾	Near mouth Waxahatchee Creek, Shelby County
16½	11½	The Bar, Chilton County
15	10½	" " " "
14	10	Butting Ram Shoals, Coosa County

This species, so far as the records show, is confined to the Coosa River, reaches its maximum development at Fort William Shoals—judging by size and the quantity of material collected—and disappears with the end of Butting Ram Shoals.

Anculosa downiei Lea

Figs. 1, 2

Anculosa downiei Lea, *Proc. Acad. Nat. Sci., Phila.*, 1868, p. 153.

The highest place in the Coosa drainage at which Mr. Smith collected this species was in the Conasauga River, east of Dalton where the stream forms the border between the two Georgia counties of Whitfield and Murray. The one shell collected there, though apparently adult, was only 11 1-2 mm. in height by 8 mm. in diameter. Near Tilton, in the same river and about fifteen miles farther down, the largest shell was 10 1-2 by 7 1-2 mm. At his next station, Resaca, Gordon County, Ga., Mr. Smith's largest *downiei* measured 12 x 9 1-2 mm.

In the Oostanaula River, the continuation of the Conasauga, the shells have reached an extreme of 14 1-2 x 10 mm. At Rome, Ga., where the Oostanaula and the Etowah rivers join to form the Coosa, the largest shell has the measurements 15 x 10 mm. But up the Etowah at Kingston, about thirty miles above Rome, the size has again dwindled, the largest *downiei* collected being 12 x 5 1-2 mm.

This is an excellent illustration of a rule often recited that the size of fresh water mollusks frequently bears a ratio to the size of the body of water inhabited. The reasons seem clear. The upper reaches of a river are in the stage of a creek, being subjected to greater relative variations than the stream farther down. The waters become low in the dry seasons, warm, often stagnant, charged with the gases of vegetable decay. The soluble foreign material brought into the creek by brooks becomes more highly concentrated than in the true river. The Anculosae, which ordinarily move about very little, are forced into an unnatural energy as a measure of self-preservation. There are alterations in the quantity of food supplies, probably alterations in the quality of this food, certainly decided changes in the chemical constituents of the water. Circumstances dictate a smaller animal and therefore a smaller protective shell.

At Black Bluff on the Coosa River, a short distance below Rome, Mr. Smith's largest specimen of *downiei* measures 17 x 10 1-2 mm., at Cedar Bluff in Cherokee County, Alabama, the size has increased to 18 1-2 x 14 1-2 mm. This last is the largest lot collected by Mr. Smith and it seems to be indicated that here the species is most flourishing. In Terrapin Creek, the same county, conditions somewhat identical with those in Georgia again obtain. The average size of the adult shells is 14 x 9 1-2 mm., the maximum, 16 x 11 mm. Changes below this point are not great, yet are noticeable. At Fitz's Ferry, the largest *downiei* measures 16 1-2 x 11 1-2 mm., at Maple Grove, 14 x 10; near Slackland, Etowah County, 15 1-2 x 9 1-2; Lonigan Shoals, 14 x 11; Fomby Shoals, 15 x 11; Leoto Shoals, 16 x 11; Riverside, St. Clair County, 15 x 10 1-2. After Cedar Bluff, it would appear, the species tends to run out numerically, and this is accompanied by physical alterations.

The shells of any one colony of *downiei* show little of the extreme variability which marks the Pleuroceridae in general, maintaining about the same proportions of altitude to diameter from young to adult.

In typical specimens, the surface of the body whorl is covered with folds from suture to base. Below the periphery these ordinarily proceed regularly to the lip and are only occasionally wavy or wrinkled. Near the suture the folds are very much waved where they "pass over" the plicae. In the case of the up-river shells, the folds are narrow, sharply cut, but as one examines the shells proceeding downstream one notices that the folds become broad, smooth upon their surface, so nearly upon a plane that in poor light the shell to the eye seems smooth. At Coosa, Georgia, specimens appear which are very nearly smooth near the base and in the Cedar Bluff lots are several individuals of this character. Of thirty shells taken at Leoto Shoals, seven only have the typical folds; in the instance of twenty the folds are obsolete or nearly so below the periphery and three are entirely without folds. It is as if a characteristic wholly absent or rare in up-river forms had become the normal habit on Leoto Shoals. In almost every lot there are a few shells whose folds are broken into beads where the plicae are crossed. The "obscure, transverse revolving striae" of Lea's description are usually not continuous, being absent or faint upon the tops of the folds. Lea lays as much emphasis upon his shells being plicate as upon their being folded. But the plicae are not a constant character. They differ in size and in number. They are not always present. Study suggests that the plicae are caused by the massing of shell material at the top of the columellae during the rest periods and that individuals are governed by no fixed natural law as to the amount of the accumulation. When new growth begins, the secretion is in smaller quantity, and thus an effect is given of minature hills and valleys, and in as much as the "valleys" are often filled with dark coloring matter the plicae in such cases stand out conspicuously.

The color bands are in the texture of the shell as well as in the epidermis, being defined most clearly within the aperture. These bands consist of interrupted deposits of pigment, customarily laid within the folds though often "spilling over" into the creases between the folds. Sometimes the

color material is so irregularly secreted that deposits of it coalesce and the aperture is given a mottled effect. In only one shell of the collection, taken at Cedar Bluff, has there been so much secretion of pigment that the aperture is uniformly dark—indicating that what is more or less common among certain species of Goniobasis and Pleurocera is rare in *A. downiei*. Differences in color between shells from near the headwaters and those from mid-river or lower are slight. The unbanded shells are ordinarily a bright shining yellow, those thinly banded olive brown and the ones with heavy bands dark brown. In the Cedar Bluff collection shells for the first time appear that carry a great deal of pigment in the body material, being pinkish by transmitted light. Several more so distinquished were in the lots from Center Landing, the same county. At Fitz's Ferry, shells appear whose "body" color is deep red. Others were found to the point where *downiei* disappeared from the river. This coloration is not a case of bands coalescing, for bands may be distinguished against the background of red. The color includes the columella, usually a porcelain white, and the operculum, ordinarily maroon.

The embryo shell seems to be only one whorl in size, usually upon the same plane as in Planorbis, but not always. One young shell taken at Fitz's Ferry has two folds at the periphery of such size as to suggest the carina of young *A. praerosa* Say.

The operculum is thin, light red to maroon. Left margin thickened, slightly curved, the right margin ragged and broadly curved, the basal margin rounded. Growth lines coarse, widely spaced, spreading like an opening fan. The polar point is typically close to the left margin, though not on the edge. The spiral lines are well defined, loosely coiled, the whorls three. The smooth Leoto *downiei* have large opercula, the left margin straighter than usual, the whorls opening broadly. These opercula, together with shell characters, emphasize the relationship of the species with *formosa*. In general, the operculum of *downiei* is lighter of color than that of *formosa*, thinner, the spiral lines more cleanly cut. Also it is lighter than the operculum of *picta*, wider in proportion to length and it lacks the straight left margin, a pronounced character in *picta*. The spiral lines of *downiei* are clear to the naked eye. A magnifying glass is necessary to make out those of *picta*.

Anculosa modesta H. H. Smith, new species

Fig. 9

Shell: Conic, about twice as high as it is wide, having broad, flat, somewhat waving folds from suture to base of body whorl. Two or three low nodules suggest plicae nearly obsolete. Lines of growth delicate, regularly spaced. No revolving lines can be made out with a glass of moderate power. Color brown, shining. Two narrow bands becoming obsolete before the peristome is reached appear on the body whorl, one at the periphery, the other just above. No bands show in the ovate, bluish-white aperture. Apex eroded, only one whorl being entire. Suture not strongly impressed, a little waving near the peristome. Columella white, delicate, smooth, rounded, with only small deposits of callous top and base. Peristome thin, nearly straight, sharp-edged, a little broken.

Operculum: Very thin, reddish, 5 mm. in altitude, 3 mm. in diameter. Lines of growth fine, interrupted by occasional heavier lines which give the operculum the appearance of an opening fan when viewed by transmitted light. Left margin slightly curved, right margin broadly curved, thin and torn. Apex acute. Polar point, crater like, somewhat large for so small an operculum; it is located on the left margin about 1 mm. above the base. Spiral lines loosely coiled. About one and one-half whorls within the operculum can be traced. Area of attachment small, narrow, elongate.

Measurements of type: Altitude, 11 mm.; diameter, 7½ mm. Aperture—altitude, 6 mm.; diameter, 3½ mm.

Type locality: Coosa River, Riddle's Bend, Cherokee County, Alabama. Collected by Herbert H. Smith, October, 1904.

Type in the Museum of Zoology, University of Michigan. Paratypes in the Alabama Museum of Natural History.

This species is confined apparently to the Coosa River in Cherokee and Etowah counties, Alabama, above the middle river shoals. Mr. Smith's shells come from only three localities, rather close together. *Modesta,* to all seeming, is a small local race whose affinities are closest to *A. downiei* Lea. It differs from that species in being smaller, having weaker folds, less pronounced plicae, a greater tendency to vary. The bands are not so numerous. The operculum of *modesta* is much thinner and shows a more decided variability. The impression is given that in the case of this species the operculum has lost much of its usefulness as a protective organ.

Of 34 specimens from Riddle's Bend 1 has quite strong folds, 27 are moderately folded suture to base, in 4 the folds can be made out only with a glass and in the case of 2 shells there are no folds. No revolving striae were seen. The plicae consist mostly of flat nodules, irregular, seldom continuous in any one specimen.

The color varies from a shining yellow to light brown. The banding arrangement is four thin, continuous bands. Only one modification, other than that in the type, was noted, a single banded specimen lacking the basal band. Many shells have bands in the epidermis which do not show in the aperture. The number of specimens lacking bands exceed those with them.

The columella is usually porcelain white, sometimes cream-colored, uniformly regular and rounded. The variation in the peristome is exceedingly slight, this character being usually straight, sometimes a little curved near the suture.

The operculum is of the *picta-formosa-downiei* type, but is evidently degenerating and varies accordingly in size, form and scupture. Two opercula were observed to have curious little pits upon the anterior side as if diseased. This has not been remarked in the case of any other species.

Measurements:

Altitude	*Diameter*	
11½ mm.	7 mm.	Riddle's Bend, Cherokee County
11¼	7¼	" " " "
10¼	7	" " " "
9	6¾	" " " "
12	8	Below Minnesota Bend, Cherokee County
10	7	" " " " "
12	8	Fitz's Ferry, Etowah County
11¼	7½	" " " "
10½	7½	" " " "

Anculosa taeniata (Conrad)

Fig. 10

Anculotus taeniatus Conrad, *New Fresh Water Shells of U. S.*, p. 63, 1834.

This species has the longest range of any of the Anculosae of the Alabama system. Conrad described it from Clairborne, which is much nearer to the Gulf of Mexico than it is to the mouth of the Coosa River. Mr. Smith collected it as high on the Coosa as the northeastern point of St. Clair County and on all the big shoals below as far as Wetumpka. Material in the Schowalter collection is credited to the Cahaba River. It has been taken at Selma on the Alabama below the mouth of the Cahaba. Doubtless it could be found in favorable locations between this place and the type locality at Clairborne, and possibly beyond.

The variation in *taeniata*, while considerable, is not as confusing as that of several others of the species under consideration. There appear to be no more than a few clearly traceable offshoots. In form the species is heavy, subangular, usually shouldered or humped, often longitudinally produced. Lines of growth are very fine and close together. These are crossed, though not in the case of all shells, by revolving lines which are usually discontinuous and often undulate. Viewed under a glass this sculpture, when well marked, gives the surface of the shell the appearance of peach down. Shells with folds mostly confined to the shoulder appear in nearly all the lots, these being more common in material from the lower part of the Coosa than from the upper. Of 81 *taeniata* from Ten Island Shoals, St. Clair County, 64 were smooth, 17 had folds at the shoulder. Out of 74 from The Bar, Chilton County, the smooth shells numbered 56, those with folds 18. Yet there is actually no striking change in sculpture from the St. Clair County stations to Wetumpka.

The columella of *taeniata* is usually fairly stout, smooth, rounded, regularly developed and lacking the "buttressed" callous present in the equally large *A. formosa* Lea and *foremani* Lea. In old specimens of *taeniata* the face of the columella is sometimes ground down as if against the rocks, so as to give it the flattened appearance characteristic of some of the other species of Alabama Anculosae. Changes in the color of the columella from north to south were observed. Of 81 shells from Ten Island Shoals, 58 had the white columella, 5 were pink, 18 were streaked or spotted with purple or brown pigment. The columellae of the Truss Shoals shells were purple without exception. At the Three Island Shoals, the white columella became rare and at Ft. William Shoals one lot of 70 shells had only one specimen with a white columella. The columellae of Weduska Shoals material were purple or reddish while those of the shells from The Bar were all purple. The few shells from the Cahaba in the Schowalter collection had the white columella slightly touched with color. Fading in these specimens was marked.

The peristome of this species is ordinarily straight, sometimes slightly curved close to the suture; strong, sharp-edged.

The upper river shells are yellowish to olive-brown, the bands being well defined. Material from the lower part of the Coosa are much darker, less

shining, the bands more obscure. A mottled effect as in *flammata* and *zebra* mutations is rather rare, as is also the occasions when the coloring matter of the bands has spread throughout the shell.

Fifteen arrangements of bands were noted in this study—the arrangement of four equidistant bands prevailing. Nine arrangements were modifications of this formula, these being exceedingly uncommon and so indicating that they represent merely individual variation or aberration. Few shells without bands and few with the bands broken into squares or oblongs occur in the upper parts of this species' range. Below Lock 4, broken bands become predominant. In nearly every lot one to several shells occur which have bands upon the epidermis that do not show in the aperture.

The nuclear shell of *taeniata* is smooth, loosely-coiled, having about one and one-half whorls. Of seven juveniles from Ten Island Shoals, the columellae of six were white or pink and one was purple. All these shells were four-banded, the peristome flaring; no angulation occured at the periphery.

The operculum is elongate, reddish-brown, with growth lines fine to coarse, closely set together. The left margin is firm, very slightly rounded. Apex rounded. The right margin is thin, often broken and uneven, curved. The basal margin is broadly rounded, frequently worn or ragged. In ten opercula examined, the polar point of five was upon or close to the left margin. In the other half, it was nearly in the center of the basal margin. This shifting of position was due to wearing. The nucleus is very small, indented, crater-like. Such spiral development as can be made out in most of the opercula is closely confined to a very small space near the base, and in only one specimen examined was it possible to trace the full three whorls common to the operculum of species of this genus. The area of attachment is elongate, oval. In a small form of *taeniata* which Mr. Smith separated from collections at Ten Island, Three Island and Butting Ram shoals, the chief differentiation is an elongated, narrow operculum with a straight left margin.

Measurements of shells:

Altitude	*Diameter*	
17½ mm.	11 mm.	Clarence Shoals, St. Clair County
16	11	Lonigan " " " "
20½	14½	Ten Island Shoals, St. Clair County
18	12½	" " " " " "
15½	11½	" " " " " "
17	12	Lock 2, St. Clair County
16½	12	Truss Shoals, St. Clair County
16	10½	Three Island Shoals, Talladega County
20	13½	Ft. William Shoals, " "
20	13	Peckerwood Shoals, " "
19	13	Weduska Shoals, Shelby County
17½	12	" " " "
22	15	The Bar, Chilton County
21½	14½	" " " "
20	14½	" " " "
16½	11½	" " " "
16½	12	Wetumpka, Elmore County

Anculosa torrefacta H. H. Smith, new species

Fig. 11

Shell: Smaller than and not so heavy as the adult of *A. taeniata* Conrad, the species to which it is most closely related. It is subglobose, subangulated, slightly indented at the base. Lines of growth fine, close together, crossed by revolving striae, usually wavy and not always continuous. Just below the suture to within eight or ten millimetres of the peristome are low, broad nodules which are made to appear larger than they are by reason of spots of dark pigment between them, these nodules probably being the nearly obsolete remains of plicae. The type has no folds. The body color of the shell is red-brown, rather dull, looking as if burned. It is broken by four wide, continuous bands of purple. Apex eroded, the body whorl alone remaining. Suture irregular. Peristome sharp-edged, slightly sinuous, a little curved close to the suture. Columella smooth, regular, rounded, the callous not very heavy for a shell of this size; it is colored with purple, this being lighter at the base of the columella. Aperture ovate, reddish, marked with the four purple bands, one of which is lighter in tone than the others.

Operculum: Dark, reddish brown, thick; altitude 8 mm., diameter 4 mm.; the whole leaf-like. The left margin is nearly straight, the apex acute, the right margin firm, irregular; basal margin rounded. The polar point is small and at the base of the left margin. Area of attachment elongate, rounded at base, apex acute; bordered by a ridge of black callous.

Measurements of type: Altitude, 16 mm.; diameter, 12 mm. Aperture—altitude, 12 mm.; diameter, 7 mm.

Type locality: Coosa River, Weduska Shoals, Shelby County, Alabama. Herbert H. Smith, collector, August, 1913.

Type in the Museum of Zoology, University of Michigan; paratypes in that museum and in the Alabama Museum of Natural History.

This species is apparently confined to the Weduska Shoals. It represents an offshoot of *A. taeniata* and resembles to a degree the smooth forms of *A. griffithiana* Lea. Not all of the shells have the microscopic sculpture of the type, though it is common to most. Shells were found in the Smith collection the early whorls of which were decidedly plicate and one specimen bore two waving, narrow folds at the shoulder and dim, very flat folds on the base. A second specimen had widely spaced, nearly obsolete revolving lines like the channels between the ribs of sulcate Anculosae. Forms much constricted of body whorl were not uncommon.

On old shells, the columella is nearly always eroded at the umbilicus. Material with the columella white is rare; in banded shells this character is commonly purple, in unbanded specimens reddish. The curved peristome is present in all the ligulate shells, common though not pronounced in others. Specimens with straight lip are about one in four or five.

Four equidistant bands are the prevailing banding arrangement, these being usually broken into square or oblong markings. Shells with continuous bands as in the type are about one in six.

Torrefacta has a humped squat look and when numbers are laid out on a table they remind one of pictures of Indians sitting at council with blankets over their shoulders.

The operculum varies somewhat, the lines of growth being sometimes interupted by coarse lines representing the rest periods, the apex varying from acute to rounded, the left margin being as often curved slightly as straight. The right margin, particularly in young shells, is often torn, the

the basal margin usually so. The nucleus is small, pit like. The number of whorls is probably three. Such spiral lines as can be made out under the glass become lost in the material of the operculum after about one and one-quarter whorls.

Measurements of shells:

Altitude	*Diameter*	*Altitude*	*Diameter*
19½ mm.	13½ mm.	17 mm.	12½ mm.
18½	12½	16½	11½
18	13	15½	11¼
17½	12	15	11

All are from Weduska Shoals.

Anculosa coosaensis Lea

Fig. 13

Anculosa coosaensis Lea, *Proc. Nat. Acad. Sci., Phila.,* March, 1861, p. 54.

This species, in Tryon's opinion, was the half-grown form of *A. taeniata* Conrad. Specimens of *coosaensis* in the Alabama collection show all the marks of maturity in the matter of shell deposit. The animal abandons its spire and confines its life to the body whorl, as in the mature of other forms. The shell experiences proportionally the same erosion. Tryon's decision, it may be, came about from the fact that certain specimens of *taeniata* taken by Dr. Schowalter in the Alabama River at Selma are so dwarfed as superficially to resemble Lea's species. A larger series of the true *coosaensis* than Tryon had before him would, in all likelihood, have prevented this mistake.

The species is apparently one of the most narrowly confined of the Anculosae. The explorations of Mr. Smith brought it to light only on the Fort William and the Peckerwood shoals of the Coosa River, the second group of shoals being not much more than an extension of the first. Because of this perhaps the variation in form is not great. Ordinarily the body whorl is flattened, but it is sometimes slightly constricted. Specimens occur which are subangulated, though typically the periphery is rounded. Numbers of the young are subglobose rather than conic.

Sculpture consists of fine to rough growth lines, crossed by striae which are sometimes but not always continuous, waving to straight. At times these revolving lines are more nearly to be described as raised than incised. A few shells were found with folds, also a few with sharp carinae as in the young of *A. praerosa* Say. The plicae when they appear are never more than flat, broad nodules with spots of dark coloring matter between them which brings them into prominence.

Color varies from yellow to dark brown, a few shells being reddish, a few green. Young shells are more apt to be greenish than older ones. The banding formula is usually four equidistant lines of color, continuous or broken. Of the eight arrangements of banding noted, seven were simple modifications of the prevailing system. Ninety-five shells in a Fort William Shoals lot were banded in epidermis and aperture, 6 in the epider-

mis only, 1 was without bands and 1 was streaked with color irregularly after the pattern of the shells known as *flammata*.

The columella of *coosaensis* is smooth, regularly developed, the larger callous at the top not particularly strong. As in the case of other species of this group, the outer edge of the columella is flattened near the umbilicus, being at right angles to the body whorl. This character is not always present or when present well marked. In color, the columella is purple or reddish, white being uncommon. In one lot, 87 had the columella purple, 16 with it slightly colored red or purple, 1 with this inner lip white. The peristome is straight or slightly curved near the suture.

The embryo shell seems to consist of about two small, smooth whorls, tightly coiled, sometimes elevated, sometimes on the same plane. Five or six whorls for the fully grown shell are indicated.

The operculum is elliptical or ovate, moderately heavy, light to dark red. Lines of growth are fine to coarse. In some opercula these lines are crossed at right angles by waving striae. Rest scars are not prominent or easily to be differentiated from growth lines. Apex usually rounded, sometimes acute. Curves of the margins unequal. The polar point is slightly raised, and normally is upon or near the left margin near the base. The whorls are three. The spiral development can seldom be made out; it is closely confined to the area near the polar point.

Measurements of shells:

Altitude	*Diameter*	
17½ mm.	9½ mm.	Coosa River, Schowalter collection
17	10	" " " "
16	10	" " Mohr "
15½	10½	Ft. William Shoals, Talladega County
15¼	9¾	" " " " "
14½	10	" " " " "
14	9	" " " " "
13½	10	" " " " "
13½	9	" " " " "
13	8½	" " " " "
11	8	" " " " "
11½	8	Peckerwood " " "

Anculosa griffithiana Lea

Fig. 15

Anculosa griffithiana Lea, *Proc. Amer. Phil. Soc.*, II, p. 83, July, 1841.
Anculosa rubiginosa Lea (?), *Proc. Amer. Phil. Soc.*, II, p. 83, July, 1841.

Following the example of Tryon, collectors and authors have usually given precedence to the name *rubiginosa*, a species described by Lea at the same time and upon the same page as *griffithiana*. The former species was, however, put down as a shell of "Warrior River", whereas the locality of the species under discussion here was given as the Coosa River. Only one character—"columella, thick, dark purple"—appears to point to the Coosa mollusk, while the rest of Dr. Lea's description of *rubiginosa* can apply to a smooth and fairly common form of *A. plicata* Conrad which does inhabit

the Black Warrior. Furthermore, occasional specimens of *plicata* have the "columella thick, dark purple". As against an argument that *rubiginosa* was not actually a Coosa shell it might be recited that Lea had the carelessness of his contemporaries in regard to type localities. But unless the one shell from which Lea described *rubiginosa* can be found and positively identified as his type, the uncertainty will remain. It seems best to employ the name *griffithiana,* and that this was Mr. Smith's belief is indicated by some of his labels.

The species has a narrow range. It occurs in great numbers at Wetumpka and it is from this place that most of the shells in the collections have come. Eight miles north, it is less flourishing—to judge from Mr. Smith's collections there. At Noble's Ferry in the same county, only one specimen of the species was taken by Mr. Smith. No locality is given for *griffithiana* above the northern line of Chilton County which by air line cannot exceed forty-five miles from Wetumpka. One lot of *griffithiana* from the Schowalter collection bears a Cahaba River label. These shells appear to be identical with Wetumpka material, and as Mr. Smith himself did not find the species in the Cahaba this may be considered an error on the part of Dr. Schowalter.

The shell as a rule is stoutly folded from suture to base, the folds being most pronounced in the Wetumpka shells. Smooth specimens or nearly smooth appear in all the lots, the greatest number coming from The Bar, Chilton County. In one lot from Wetumpka about one individual in eight is without folds. In another lot, one shell in four is without folds, one in eight has folds nearly obsolete. On the upper whorls of the shell are faint indications or remains of plicae. The fine growth lines are usually well defined, though upon some of the older specimens and on top of the folds of many others these lines have worn away. Microscopic revolving lines can be made out on most of the material. They show most plainly on shells devoid of folds.

Seven arrangements of the bands were noted in this study, the most common being four rather heavy, continuous, equidistant strata of coloring matter. Among Wetumpka shells, about twice as many unbanded specimens occur as banded. About one shell in twenty-eight has bands upon the epidermis which do not show in the aperture; about one in thirty-five has bands broken into squares as in the case of other species of this group. Among folded shells from The Bar which Mr. Smith separated from smooth forms, more banded than unbanded shells appear, the ratio of the one to the other being three to one.

The columella of *griffithiana* is rounded or angulated. It is usually stained with purple, red or pink coloring material. Shells with a white columella are rare. A characteristic of the species is that the columella covers the umbilical niche rather poorly. In some specimens a slight, eroded groove or hollow is left and in few specimens is the base covered completely and smoothly. The color of the shell ranges from yellow to dark brown, red shells are not uncommon and occasionally slightly mottled shells appear.

The peristome is very slightly curved near the suture, is sharp-edged and in heavily-folded shells it tends to be sulcate.

The nuclear whorls are tightly coiled, smooth and not upon the same plane, the embryo shell appearing to be one and one-fourth to one and one-half whorls in size. In one young and uneroded specimen the nuclear whorls are bright red, smooth, elevated; the second whorl dark green, slightly carinate, shining and smooth between the carinae; the third whorl angulated at the base, folded, having four interrupted bands. In another juvenile the second whorl has a slight beading at the top close to the suture, a spot of color occuring between nodes.

The operculum is dark red by transmitted light, about twice as long as wide. Lines of growth are pronounced, the margins thickened and usually smooth, the apex pointed though sometimes rounded. The polar point is at the edge of the left margin below the center. The operculum is usually "indented" at the polar point where the animal has rubbed the operculum against the columella. In instances, the basal margin has been worn away until the nucleus rests upon the base. The spiral lines in most of the opercula examined are very nearly obsolete. Three whorls are indicated, the first two very tightly coiled. Tryon illustrated a specimen of *griffithiana* with tongue-shaped operculum, but makes no mention of it in the text. Numbers of shells with opercula of this nature are in the Alabama collection. This form is described elsewhere.

A label in a tray of Wetumpka *griffithiana* reads: "On rocks in swift water less than 4 feet deep when the river is low."

Measurements of shells:

Altitude	*Diameter*	
20½ mm	11½ mm.	Wetumpka
18½	11	"
17	12	"
16	12	"
15½	10½	"
15	10	"
13	9	"
15	10	Eight miles above Wetumpka
13½	10	" " " "
11½	8½	Noble's Ferry, Elmore County
12	9½	Butting Ram Shoals, Coosa County
12	9	" " " " "
11½	8½	" " " " "
14	10	" " " " "
13	9½	" " " " "

Anculosa aldrichi H. H. Smith, new species

Fig. 16

Shell: Subglobose, smooth, shining, subangulate, the base somewhat flattened and indented. Color of epidermis light brown, crossed by four dark, discontinuous bands each about 1 mm. wide. Within the aperture these bands appear against a bluish-white background of shell material. Apex eroded, the body whorl alone remaining entire. Lines of growth fine, regularly spaced, interrupted by three rest-period scars which are rather narrow, two of them being raised above the surface of

the shell. The growth lines are crossed by very delicate, microscopic revolving striae, waving, broken, absent on some parts of the shell. Suture a little irregular. Aperture ovate. Columella moderately stout, rounded except on the outer edge at the center where it is flattened. Peristome sharp-edged, but firm, a little curved close to the suture.

Operculum: Dark, rather thick, lines of growth very fine, rest scars not heavy. Size 5 mm. by 3½ mm. Apex rounded. Curves of left and right margins nearly equal. The base of the operculum of the type is lighter colored and thinner than the rest of the operculum, indicating that it has been renewed after injury or wear. The polar point is small, very slightly raised above the plane of the operculum. It is on the left margin near the base. One and one-half whorls of the closely-coiled spiral development are traceable. The area of attachment is elliptical, the edges thickened with dark callous.

Measurements: Altitude, 13½ mm.; diameter, 10 mm. Aperture—altitude, 6½ mm.; diameter, 5 mm.

Type locality: Coosa River, near mouth of Yellowleaf Creek, Chilton County, Alabama. T. H. Aldrich, collector.

The type is in the Museum of Zoology, University of Michigan; paratypes in that museum and the Alabama Museum of Natural History.

This is a localized race, being apparently confined to one shoal of the Coosa River. It has the general appearance of *A. taeniata* Conrad, but it is uniformly smaller, less shouldered, flatter of base. The affinities seem to be closer to *A. griffithiana* Lea, which it resembles in form, in both the normal and the produced opercula, and in the tendency to develop the folds characteristic of the *griffithiana* most common to collections. There are specimens which are hard to distinguish from *A. coosaensis* Lea and some of the young are very like the juveniles of *A. ligata* Anth. *Aldrichi* is a good illustration both of the variability of these Coosa races and the marked habit of any given form of Pleuroceridae in any one locality to resemble all other forms there.

The microscopic sculpture varies in strength and it sometimes occurs that the longitudinal lines are less prominent than the revolving lines. Specimens with folds are not uncommon, but the variation from flat and scarcely perceptible elevations to rib-like folds, and their irregularity in many instances probably argues that the character is not fixed or directly inheritable. Material with plicae is comparatively rare, and where it occurs the plications consist merely of low, flattened nodules made a little striking to the eye by spots of dark coloring matter between them.

The color of *aldrichi* varies from yellow to dark brown, olive-green specimens being not uncommon. The larger number of individuals is banded, and often these bands coalesce so that the epidermis has a "zebra" effect. The prevailing banding arrangement is four continuous or broken lines of color, variations consisting of modifications of this formula. In one lot, 111 shells had four bands, mostly discontinuous and frequently with the two inner bands joined or nearly so; 13 had one or more bands suppressed; 74 had bands in the epidermis that did not appear in the aperture; 8 were without any bands.

The embryo shell is very small, smooth, tightly coiled, only slightly elevated. The uneroded adult would probably have five whorls.

The operculum of the type resembles most of the opercula examined,

there being variations in the curve of the margins and the position of the polar point, the form of the apex and the extent of the wear and tear experienced. Perhaps a dozen *aldrichi* were found to have the produced operculum, noted in *griffithiana*. The normal operculum of the latter species is larger than that of the species under discussion, as is also the operculum of *taeniata*. There is, however, a clear resemblance in the opercula of the three species, and *coosaensis* may be included.

Measurements of paratypes:

Altitude	*Diameter*	*Altitude*	*Diameter*
15½ mm.	10¾ mm	13 mm.	9½ mm.
14¾	11	13	9
14	10	11	7½
13½	10¼	10½	8½
13	10		

Anculosa flexuosa H. H. Smith, new species

Fig. 17, 18

Shell: Subglobose, rather heavy, surface broken with stout folds from suture to base and having a half-dozen low, broad nodules at the shoulder which give a flattened effect to parts of the body whorl. Apex flattened, partly eroded. Growth lines fine, worn away in places upon the tops of the folds. Suture impressed, irregular. Aperture broadly ovate, bluish-white, the channels between the surface folds showing through. Peristome a little curved below the suture, quite thin, slightly crenulate. Columella of the type specimen deep purple, rounded, flattened on the surface from the center nearly to the base. Color of shell, buckthorn brown. Within the aperture appear a few spots of color, all that the type has of color bands or lines.

Operculum: Very thin, reddish, translucent, small for so large an Anculosa. Apex acute. Left margin firm, nearly straight, curving abruptly to the apex. Right margin thin, torn, broadly curved. Basal margin worn and broken. Growth lines fine. The polar point is located at about where the left and basal margins meet. Nearly two whorls may be made out within the operculum with the glass. The area of attachment is narrow, elliptical, the deposit of dark callous on the edges being small.

Measurements: Altitude, 17 mm.; diameter, 13½ mm. Aperture—altitude, 10 mm.; diameter, 7¾ mm.

Type locality: Coosa River, Wetumpka, Elmore County, Alabama. Collected by Herbert H. Smith, October, 1903.

Type in the Museum of Zoology, University of Michigan; paratypes in that museum and the Alabama Museum of Natural History.

This species, so far as known, is confined to the vicinity of Wetumpka unless a somewhat puzzling shell more nearly conic, taken by Mr. Smith at Duncan's Riffle, Chilton County, can be assigned to it. Specimens taken by Schowalter, Call and T. H. Aldrich have been brought together in the Alabama collection, indicating that while *flexuosa* is not exactly a common mollusk it cannot be pronounced rare. Possibly it has been fairly widely distributed as *A. formosa* or *griffithiana* by Dr. Schowalter, as individuals have been found in some of Dr. Schowalter's boxes or trays which bear these labels.

Most of the material, like the type, is heavily folded. But a few spec-

imens appear which are wholly or nearly smooth. The nodules are not constant, and when they are present they vary in strength. Judging from the shells examined, color bands or lines are tending in this species to become obsolete. Of 11 specimens in one lot, 7 were without bands or lines, 3 had fine lines broken or continuous, 1 had an arrangement of four very dark continuous bands. The type specimen lacks the heavy callous at the top of the columella, present in some of the material which evidently is older. The columella is ordinarily strong, broad, rounded, tending to become slightly flattened on the outer surface and on the edges near the center. Of the 11 specimens of the one lot mentioned above, the columella was white in 1, purple in 2 and reddish or salmon in the case of 8. The outer lip is sinuous more often than not.

Two forms of operculum were observed, one which is of the *griffithiana* type and the other suggesting relationship with the *picta* group.

Flexuosa is much more robust than *griffithiana* and the development of fine color lines is foreign to that species. Considering size, color lines, opercula and general shell texture and sculpture one might be inclined to think the form a hybrid of *griffithiana* and *picta*. Yet the absence of evidences of hybridization elsewhere in the genus Anculosa discourages this idea.

Measurements:

Altitude	*Diameter*	*Altitude*	*Diameter*
19½ mm.	14½ mm.	17¼ mm.	13 mm.
19	14	14	11½
18	13½	14	11

All from Wetumpka.

Anculosa choccoloccoensis H. H. Smith, new species

Fig. 14

Shells: Obtusely ovate, not heavy, lines of growth rather coarse; spiral striae over parts of the shell, undulate, obscure, not continuous; rest scars prominent. Apex eroded. Suture impressed, a little irregular. Color buckthorn brown; shining; epidermis showing four interrupted bands, the basal band very faint; bands appearing in aperture as lines of dark dots or oblong markings. Columella reddish, strong, rather heavy in the center, regularly curved, the outer edge flattened and nearly at right angles to the body whorl; at the base projecting slightly over the epidermis. Aperture ovate, peristome very thin.

Operculum: Thin, reddish, 7¼ mm. in altitude, 3¾ mm. in diameter. The left margin is nearly straight; right margin curved, firm; basal margin broadly rounded; apex acute. Lines of growth fine. Nucleus indented, located on left margin close to the base. Whorls three, closely coiled. The area of attachment to the foot is narrow, elliptical.

Measurements: Altitude, 13¾ mm.; diameter, 11¼ mm. Aperture—altitude, 6½ mm.; diameter, 5½ mm.

Type locality: Choccolocco Creek at Jackson Shoals, Talladega County, Alabama. Collected by Herbert H. Smith, September, 1905.

Type in Museum of Zoology, University of Michigan; paratypes in the Alabama Museum of Natural History.

This species was collected by Mr. Smith at three localities, Jackson Shoals, Eureka and two miles above the Coosa River, all the stations being upon Choccolocco Creek and within Talladega County. There is only slight variation in the material, though the shells taken at Eureka are uniformly more slender than the Jackson Shoals specimens. In shell characters the adult mollusk is closer to *A. taeniata* Con. than to any other species, but the two carinae on the whorls of the juveniles might seem to indicate a relationship with *A. ampla* Anth.

Six specimens of the type lot are smooth, shining, with only faint revolving striae; 2 have well-marked revolving striae and are somewhat duller; one has a fold 2 mm. below the suture, crossing low plicae and giving a banded effect. A shell from Eureka has fine, erect lines from suture to base, continuous and undulating.

The banding arrangement consists of four lines, usually interrupted, these showing more often in the epidermis than in the shell material of the aperture. A single shell only has five bands.

The columella is normally rounded, rather large; in one old specimen it is heavy and buttressed at the top as in Anculosae of the *picta* group. The color of the columella varies from white to purple.

The embryo shell is small, tightly coiled, the apex elevated. It consists of about two whorls. The juvenile shell does not enlarge rapidly. It has two well-defined carinae at the periphery, characteristic of the young of *A. praerosa* Say, *ligata* Anth. and creek forms of *ampla* Anth. All the juveniles have a weak columella. The four bands are made up of widely spaced dots. A perfect adult would probably have five whorls.

The operculum of this species is rather large in proportion to the size of the shell as compared with opercula of other members of the *taeniata* group. In paratypes, the left margin was found to be more curved than in the operculum of the type. It seemed to be the tendency of most of the animals to wear away the operculum against the columella at the thickened material close to the nucleus. In only the one specimen could the spiral lines be clearly traced.

Measurements:

Altitude	*Diameter*		*Altitude*	*Diameter*	
16½ mm.	10¼ mm.	Jackson Shoals	13¼ mm.	8½ mm.	Eureka
13½	10	" "	12	8	"
13	9½	" "	10¾	8	"

Anculosa brevispira H H. Smith, new species

Fig. 12

Shell: Subglobose, suggestive of *A. ampla* Anth. Longitudinal growth lines rather fine, regularly spaced, crossed over part of the shell by discontinuous revolving lines. Apex slightly eroded, flattened, the whorls developing with remarkable rapidity, this expansion beginning immediately after the embryo whorls. Suture impressed. Body whorl broadly shouldered, bearing four or five low nodules with spots of dark coloring matter between them. Peristome thin, flaring, nearly straight. Columella moderately heavy, flattened nearly its whole length so as to give the inner edge a ridged

effect; color white, touched with red-brown on the outer edge close to the epidermis. Aperture broadly ovate, reddish, having four interrupted, equidistant bands about 1 mm. in width. Color of shell buckthorn brown.

Operculum: Dark red, somewhat thin, in shape like a minute willow leaf; more narrow in proportion to length than the operculum of *A. taeniata* Conrad. Growth lines are well marked, but not particularly heavy. Left margin nearly straight, right margin curved, firm; basal margin broadly rounded, worn. Apex slightly rounded. The polar point is on the left margin close to the base. No trace of the spiral lines can be discovered under the glass. The area of attachment occupies slightly more than half the posterior surface, being elliptical, edged with dark callous.

Measurements: Altitude, 13½ mm.; diameter, 10½ mm. Aperture—altitude, 7½ mm.; diameter, 5½ mm.

Type locality: Fort William Shoals, Coosa River, Talladega County, Alabama. Collected by Herbert H. Smith, June, 1914.

Type in the Museum of Zoology, University of Michigan; paratypes in that museum and the Alabama Museum of Natural History.

This species varies greatly in form, most specimens having the characteristically expanded aperture, but many being as conic as *griffithiana* Lea or *taeniata* Conrad. The young do not closely resemble the adults, the mature characters developing with about the third whorl. The peristome of the juvenile shell is not flaring; it curves at the suture over the early deposit of columellar callous. The upper part of the whorl is more shouldered than in most of the old shells. The affinities of *brevispira* are somewhat obscure, but the impression given during the study of the species is that it is near to *taeniata*.

Numbers of the specimens are folded or slightly ribbed. Occasional specimens bear nodules at the top of the body whorl which may indicate descent from a plicate state. In one lot, 9 individuals have folds from suture to base which vary in strength; 19 have folds at the shoulder only; 59 are entirely smooth.

The color of the epidermis ranges from snuff brown to sepia and a few specimens have the dark mottled appearance of some *A. showalterii* Lea. The bands are usually four in number, continuous or broken. Three variations of the banding arrangement from the normal formula were observed, and each lot collected by Mr. Smith contains shells without bands.

The columella, flattened and a little angular rather than curved, seems to be one of the most definite characters of this race. The lower outer edge is not raised so distinctly above the "abutting" epidermis as in the case of *ampla*. The color of the columella is usually purple. In some it is white and in many specimens it is splotched with purple or red, the ground color being white or pink.

The embryo shell is minute, one and one-half whorls in size, the apex a little raised. The second whorl when completed is very large as compared with the nuclear section. An adult probably has four whorls.

One doubtful specimen of *brevispira* was taken at Three Island Shoals. The species appears to be exceedingly common on parts of Fort William Shoals. It was not found apparently from there down the river until The Bar and Duncan's Riffle in Chilton County were reached, though doubtless it does exist at favorable stations between these shoals. Lower river speci-

mens, rather rare, vary somewhat from typical forms, but are quite recognizable.

The operculum of *brevispira* is very small in proportion to the aperture. As seen in the shell it lies close to the columella, the apex fitting into the corner between the columella and peristome with a little room to spare. At the base, however, is a wide gap and nearly one-third of the aperture between the right margin of the operculum and the peristome is left unprotected.

Measurements:

Altitude	*Diameter*			
18 mm.	13 mm.	Fort	William	Shoals
17½	13½	"	"	"
16½	12¾	"	"	"
15½	11	"	"	"
15½	10¼	"	"	"
14	10	"	"	"
13½	11	"	"	"
13½	9½	"	"	"

Anculosa ampla Anthony

Fig. 23

Anculosa ampla Anth., *Annals N. Y. Lyc. Nat. Hist.*, VI, p. 158, pl. v, fig. 22, 23, Oct. 1855.

Anculosa elegans Anth., *Proc. Acad. Nat. Sci., Phila.*, Feb. 1860, p. 69.

In point of distribution this species is one of the most interesting and certainly the most puzzling of the Anculosae of the Alabama drainage. It is the characteristic member of the genus in the Cahaba River. In the Coosa it has been found sparingly at Wetumpka, close to the mouth of that river, and there only. But north of Wetumpka the species has been collected in five western and three eastern tributaries of the Coosa.

Not another Anculosa of the drainage has so strange a distribution. If this were due to environmental requirements on the part of the species, one might expect to find a similarity in the habitats of *ampla*. There is anything except similarity. In the Cahaba drainage the species occupies not merely the parts which are river-like in character, but also the upper reaches where the conditions are those of a creek, the Little Cahaba River which is more creek than river, and a mineral spring five miles from Centerville which is on the Cahaba. The difference between the Coosa tributaries and the Coosa proper at Wetumpka is that between small streams with lively but not very heavy current and a large river with a strong and, for many months in the year, a deep current. Other Anculosae of the Alabama system are distributed with known or apparent continuity. For example, *A. downiei* Lea lives in the Coosa drainage from the Conasauga to just beyond the middle Coosa Shoals, *A taeniata* Conrad from the middle Coosa to Clairborne on the Alabama.

The explanation for the unusual distributional record of *ampla* which

seems most reasonable at this time is that the species is a relic of a race dating far back in geological time and in the comparatively recent and quite noticable evolutionary alteration of the Coosa mollusca it has disappeared from that stream except at Wetumpka, holding its own only in the tributaries. The ancient lineage of *ampla* is possibly indicated in the shell itself, some juvenile forms of it having characteristics strikingly resembling *A. praerosa* Say of the Tennessee system.

The usual form of *ampla* is subglobose, the aperture ovately rounded, the body whorl shouldered at the suture and there often bearing folds and plicae. Yet in nearly all lots of Mr. Smith's collection many specimens appear which are conic, the aperture narrowly ovate or even elliptical, the surface wholly free of folds and plicae. The pronounced sculpture is more common to the shells of the Cahaba than to the material from the Coosa creeks. Where folds and plicae both occur the region near the suture is usually broken by nodules or tubercles, resembling in this regard *A. plicata* Conrad of the Black Warrior. In the creek forms these characters vary with localities—being a marked feature, for instance, of the Canoe Creek specimens and entirely absent from the Waxahatchee, Buxahatchee and Warson collections. The growth lines of *ampla* are rather strong, the revolving lines usually obscure or often absent.

The species is yellow, dark brown or olive green. The creek forms are easily distinguished from those of the rivers by being brighter, the epidermis having escaped the erosion from sand and the common accidents of heavy currents. About fifteen different arrangements of bands were observed in this study, but most of them were merely modifications of the prevailing formula of four equidistant, interrupted or continuous bands. The creek forms show no marked difference in this character from those of the rivers, though unbanded specimens appear to be rarer in the creeks than in the other localities. In one lot of 224 specimens from Lily Shoals of the Cahaba, 33 were without bands.

The inner edge of the columella of *ampla* is ridged rather than rounded as in other groups of Anculosae. This is plainer in young and half-grown specimens than in the adult. It is not usually flattened on the outer edge, though one lot of creek shells shows this characteristic in virtually all the specimens. The lower third of the columella is produced or flattened as if smoothed with a palate knife. In color the columella is white, red or purple, this last color being the most common. Occasional lots, as those from the Coosa at Wetumpka, have the columella white. The peristome is sharp-edged, firm, usually straight as if the animal held itself tightly to flat stones.

The embryo shell is small, smooth, elevated, rounded and apparently consists of two whorls. Most of the juveniles collected by Mr. Smith have the usual Anculosa form, but specimens from Wetumpka are very much flattened of apex and have the aperture flaring like Neritina. Juveniles taken in Waxahatchee Creek and in the Cahaba River at Centerville bear two carinae at the periphery as in the young of *A. praerosa* Say.

The operculum of *ampla* is dark red to brown, somewhat broader in proportion to length than in the case of *A. taeniata* Conrad. The apex is

rounded, though occasional opercula of the creek forms have the apex acute. The left margin is usually curved, but sometimes straight or nearly so; the right margin is always broadly curved, usually thin and torn; the basal margin rounded when entire. The polar point is on the left margin close to the base, the spiral lines closely coiled, the edges of the whorls within the operculum virtually disappearing after the first one and three-quarters whorls.

Measurements of the shells:

Altitude	*Diameter*	
20 mm.	13½ mm.	Cahaba River, Lily Shoals, Bibb County
17½	13½	" " " " " "
16	11½	" " " " " "
15½	12	" " " " " "
15½	10	" " " " " "
15½	11	" " Pratt's Ferry, " "
14½	10½	" " " " " "
11½	9½	Little Cahaba River
16	11½	Coosa River, Wetumpka
15½	12	" " "
15½	10½	" " "
13½	9½	Canoe Creek, St. Clair County
15	10½	Ohatchee Creek, Calhoun County
14¾	10	" " " "
14	9¾	" " " "
15	10	Kelly's Creek, St. Clair County
13	9	Yellowleaf Creek, Shelby County
14½	10½	Waxahatchee Creek, Shelby-Chilton Counties
13	10	" " " " "

Anculosa mimica H. H. Smith, new species

Fig. 24

Shell: Rather heavy, rough, in form like the subglobose forms of *A. ampla* Anth. Growth lines coarse, revolving lines apparently absent. There are four heavy folds and one light fold at the shoulder upon which are narrow nodules or tubercles suggestive of the sculpture of *Paludomus cōrinata* Reeve. The nodules are strongest near the peristome. Color of epidermis citrine, broken by three well-marked bands, these appearing in the aperture as six very dark, continuous bands. Columella strong, ridge-like at the center, flattened on the outer surface from the middle to the base, outer edge projecting slightly over the body whorl. The columella is nearly pure white and has two small blotches of purple on the inner edge. Peristome flaring as in *ampla*, thin but firm; thickened about 1 mm. within the aperture. Aperture broadly ovate.

Operculum: Similar to that of *A. ampla*. Nucleus pitted, located upon the left margin near the base. Whorls three. The operculum illustrated is slightly deformed at the left margin close to the nucleus.

Measurements: Altitude, 12½ mm.; diameter, 9½ mm. Aperture—altitude, 6½ mm.; diameter, 5½ mm.

Type locality: Little Cahaba Creek, three miles east of Piper, Bibb County, Alabama. Herbert H. Smith, collector, June, 1916.

Type in the Museum of Zoology, University of Michigan; paratypes in that museum and the Alabama Museum of Natural History.

This is a small local race, superficially resembling *A. plicata* Conrad, but more closely related to *A. ampla*. In the type lot, 21 of the shells have the folds as in the type, 10 have strong, oblique plicae crossing three to five folds and ending just below the shoulder, 3 are without folds or plicae. Two or three specimens have small folds continuing from suture to base. There is very slight difference in the form of the shells, virtually all having a flattened apex very little eroded, the flaring peristome and the flat columella.

More shells than any others had the arrangement of six bands of the type. Several modifications, however, were noted; eight specimens of the type lot, for example, having the formula of four bands which prevails in *ampla*. One shell in four of the type lot was melanic.

Little variation occurs in the columella. The color is usually purple. The peristome is straight, a little sulcate in young specimens where the folds reach the outer lip. No shell with perfect apex appears in this collection, but from specimens only slightly eroded the embryo seems to have been about one and one-half whorls in size, smooth and in nearly the same plane. The characteristic sculpture apparently develops immediately with the first growth after the nuclear whorls.

Measurements:

Altitude	*Diameter*			
14½ mm.	11 mm.	Little	Cahaba	Creek
13½	10	"	"	"
13	10	"	"	"
9	8¼	"	"	"

Anculosa plicata (CONRAD)

Fig. 25

Anculotus plicatus Conrad, *New Fresh Water Shells of U. S.*, p. 61, 1834.
Anculosa bella Lea, *Proc. Amer. Phil. Soc.*, II, p. 83, July, 1841.
Anculosa tuberculata Lea, *Proc. Amer. Phil. Soc.*, p. 83, July, 1841.
Anculosa rubiginosa Lea (?), *Proc. Amer. Phil. Soc.*, p. 83, July, 1841.
Anculosa tintinnabulum Lea (in part), *Proc. Amer. Phil. Soc.*, IV, p. 167, 1845.
Anculotus smaragdinus Reeve, *Monog. Anculotus*, t. 3, f. 23, April, 1860.

Conrad described his species as inhabiting "tributaries of the Tennessee River in Alabama." The description of *plicatus* fits the characteristic Anculosa of the Black Warrior River and not at all any mollusk of the Tennessee drainage. That Conrad collected in the Black Warrior is evidenced by his frequent references to the river in his "New Fresh Water Shells," and indeed several of his types came from that stream. If his mistake was not that of confusing notes or labels, he might very well have been under the impression at the time of collecting *plicatus* that his stream belonged to the Tennessee system, for tributaries of the Tennessee and the Black Warrior very nearly interlock.

The question of Lea's *rubiginosa* is discussed elsewhere in this paper. The recognized *tintinnabulum* Lea occurs in East Tennessee, the author

remarking superficial resemblances to *plicata* which later he would probably have considered unimportant.

The peculiar plicae for which Conrad named his species does not occur in all shells. Nor do all the shells have tubercles or beads or sculpture of that nature. The folds upon which the nodules are formed vary in number from one at the suture to several which continue to the base. On one lot from the Forks of the Black Warrior, 19 had each one fold, 5 had two or more, 18 were smooth. Of 94 from Tuscaloosa, 8 only were smooth. Material from shoals near Lock 15 consisted of 66 shells with from one to four folds, 5 with folds to the base, 19 that were smooth. The tubercules and plicae of the Tombigbee River shells were rather obscure. Fine growth lines parallel with the peristome are common to all the shells, varying slightly in strength. Faint revolving lines crossing the growth lines are to be found with a strong glass.

Eight banding arrangements were noted in *plicata* from the Forks of the Black Warrior, the number of banded individuals being only slightly in excess of those without such ornamentation. The most common arrangement was four thin equidistant lines of coloring matter, the two next most common having respectively a line at top and base and a line at suture, periphery and base. In the Jefferson County shells, the arrangement of three bands was the prevailing form and this was so also in the instances of *plicata* from Tuscaloosa and Lock 15. Frequently bands appear on the epidermis while absent in the shell material of the aperture.

The columella of *plicata* is smooth, rounded and usually the upper half is splashed with brown. It has never the gross, buttressed effect which occurs in some of the larger Anculosae of the Coosa River. The aperture is bluish-white as a rule, though sometimes pink or pure white. The peristome is sharp-edged, firm, very slightly curved. Conrad described his shell as "greenish or blackish." Uncleaned shells are covered with a black deposit of mineral matter. Green shells do occur, but brown is the most frequent color.

Even among the juvenile shells individuals with uneroded spires are extremely rare. The nuclear whorls of a specimen from near Lock 15 are smooth, elevated, without sculpture. No line between these whorls and those which follow is indicated. An uneroded adult specimen of *plicata* would probably have seven or eight whorls. Of 32 juvenile shells from the Forks of the Black Warrior, seven are as strongly carinate as the young of *praerosa* Say and serve to make plainer the relationship of *plicata* with *ampla*. The other juveniles are rounded or subangulated at the periphery.

The operculum is dark red, of moderate thickness, sometimes wider just below the rounded apex than at the base. Left margin curved, right margin slightly more so, inclined to tear. Growth lines light to coarse, occasionally fanlike as in opercula among Goniobasis. A few opercula have a wavy sculpture near the outer edge parallel with the right margin. The whorls are three, the first two being more sharply defined than in *ampla*. They are closely coiled.

Measurements of shells:

Altitude	*Diameter*	
18½ mm.	11 mm.	No label
15½	10½	Black Warrior River, Schowalter collection
17	11	Forks Black Warrior, Walker County
15½	12½	" " " " "
14	10	" " " " "
14	10	Black Warrior River, Jefferson County
13	9½	" " " " "
19	13	" " " Tuscaloosa
16½	11	" " " "
15½	9	" " " "
15	10	" " " near Lock 15
13	9	" " " " " 15
12	9	" " " " " 15
15	10	Little Warrior River
16	11	Tombigbee River
15	10	" "

Anculosa smithi Goodrich, new species

Fig. 26

Shell: Subglobose, smooth, shining, the diameter nearly equal to the altitude. Color of epidermis citrine at top and green-yellow at base. A narrow, dark band below the suture, a heavier band at the periphery, which divides into two bands, these becoming obsolete behind the peristome. The sutural band is the only one showing within the aperture. Apex eroded, only the body whorl and part of the next to the last whorl remaining. Lines of growth fine, somewhat irregular as compared with the same character in other species, these being crossed by much finer, discontinuous revolving lines—a somewhat silky appearance being given to the shell under the glass. Suture impressed, regular, a little waving just behind the outer lip. Below the suture is a rather faint line which forms a somewhat angulated shoulder upon the body whorl. Peristome sharp-edged, nearly straight, the shell thickening about 1 mm. just within the lip. Columella rounded, flattened slightly at the base, bluish-white, splashed with brown over the upper half. Aperture ovate, bluish-white.

Operculum: Thin, reddish, translucent, rather small. Growth rays fine. The left margin is curved, thickened; the right margin more curved, thin, broken. The nucleus is close to the basal margin. The spiral lines show three whorls. The operculum of *smithi* is much more like *plicata* than *ampla*, being distinguishable by its smaller size, thinness and finer sculpture.

Measurements: Altitude, 12 mm.; diameter, 8½ mm. Aperture—altitude, 6½ mm.; diameter, 3 mm.

Type locality: Valley Creek, Toadvine, Jefferson County, Alabama. Drainage of the Black Warrior. Collected by Herbert H. Smith, June 27, 1913.

The type is in the Museum of Zoology, University of Michigan; paratypes in that museum and the Alabama Museum of Natural History.

Of 93 shells closely examined, 14 had a single well-marked raised line, more or less irregular, immediately below the suture; in 24 this line was broken, discontinuous or only faintly indicated. The line did not appear on the other shells at all. This would seem to be a character connecting *smithi* with *plicata* of the main stream. About one shell in three is without

bands. Seven different arrangements of the bands were observed, the commonest consisting of a single thin band at the top of the aperture, with two bands at the base. Many of the specimens had bands in the epidermis without showing any in the aperture. In one specimen only were the bands coalesced so as to involve the whole shell. In this case the aperture was purple-colored throughout. The columellae of nearly all the shells were tinged with brown or red from top to center and the columella of one individual was tinged with purple nearly to the base.

No shell with uneroded spire was found in this lot from Valley Creek. Such parts of apices as remain indicate the nuclear whorls are smooth and loosely coiled, the whorls immediately following being without carinae. The largest number of whorls counted was four.

There is a strong resemblance between this shell and the creek and small river forms of *A. praerosa* Say of the Tennessee drainage. Also it is close to *A. plicata* Conrad. A smooth specimen of *plicata* from the Forks of the Black Warrior River, when compared with *smithi,* was flatter of whorls, angulated at the periphery rather than rounded, the columella proportionally not so heavy. A specimen of *praerosa* from Flint Creek, Alabama, a Tennessee River tributary, was slightly more conic, broad of base instead of regularly rounded, the lip having the characteristic curve of *praerosa* instead of the straightness of *smithi.* All three specimens when placed together, while easily distinguishable, yet showed a striking general resemblance. The inclination is to assume that the species under discussion represents a connecting link between the Tennessee Anculosae and those of the Black Warrior. But there is need first of an anatomical understanding of the three species and perhaps of the geological history of the western Alabama stream.

Measurements of paratypes:

Altitude	*Diameter*	*Altitude*	*Diameter*
12 mm.	8 mm.	11 mm.	8 mm.
11½	8½	11	7½
11½	8	10	7½

All are from the type locality.

Anculosa showalterii Lea

Fig. 19

Anculosa showalterii Lea, *Proc. Acad. Nat. Sci., Phila.,* XII, p. 93, March, 1860.
Anculotus sulcosus Anth., Reeve *Monog. Anculotus,* t. 6, f. 44, April, 1861.

This species appears to be confined to the Fort William and Peckerwood shoals of the Coosa River. Judging from the material collected by Dr. Schowalter and Mr. Smith, it is not nearly as numerous in individuals as many other members of the genus.

The *showalterii* which Lea described were "much ribbed . . . with seven transverse ribs . . . outer lip much expanded and very much crenulate." Mr. Smith found and identified smooth forms of the species, corresponding to the smooth forms of the usually heavily sculptured *A. griffithiana* Lea.

The size of the ribs of any individual sulcate shell may differ, and in one lot the number of ribs per individual varied from six to fifteen; in the same lot three juvenile shells had each six ribs. In partly grown specimens the ribs are undercut, i. e., the base of the rib is smaller than the outer surface. As the animal matures base and edge of the rib are on the same plane. Where the ribs fall below six in number there is usually a decrease in their size or strength, and in such instances the sculpture is best described as folds. In material from Fort William Shoals were mollusks with folds at the top of the whorl, becoming obsolete before the periphery is reached; specimens with folds at the suture and upon the base, the space between being smooth; shells with just the suggestion of folds which were confined to the top of the whorl. Fine growth lines crossed by straight or waving revolving lines appear on virtually all the specimens. They are shown most strikingly on the smooth forms, giving the epidermis the silky appearance characteristic of *A. ligata* Anth.

Ordinarily the body color of *showalterii* is very dark brown, but shells occur which are straw color, some somewhat mottled and a few in which the ribs have a lighter color than the interspaces. The bands tend to follow the ribs, but the coloring matter is sometimes absent and in other instances it is spread through the shell material irregularly. In one lot from the Schowalter collection, there are seven specimens without bands to eight having bands. The usual arrangement is four, rather heavy, equidistant bands.

The columella of old shells is heavy, rounded. Shells with a white columella occur, but in most shells it is stained with brown or purple. The crenulate outer lip of which Lea speaks is found ordinarily only in the younger shells, the furrows within the aperture seldom exceeding three mm. in length. As the animal grows older it fills these channels. The peristome has a slight curve at the suture in numbers of the specimens, but usually it is straight and in certain examples almost appressed, as if the habitat were very swift water and the animal clung tightly to the face of the rocks. The color of the aperture is white, reddish, dark red and sometimes almost black.

The embryo consists of about one and one-quarter whorls, quite loosely coiled, in the same plane and widening suddenly at the aperture. As near as can be made out from this material, a perfect, uneroded, adult would not exceed four whorls.

The operculum is of moderate thickness, dark brown or red, nearly twice as long as it is wide. Lines of growth are strong, but not coarse. The left margin is thickened, as is also the right margin in the opercula of old shells; in the young it is thin and usually torn. The left margin is nearly straight, the right curved, the apex not very pointed, the basal margin broadly rounded. Normally the polar point is close to the base of the left margin, but in old and worn specimens this position has shifted toward the center of the basal margin. On none of the material examined could the spiral lines be traced.

The shells of adult animals differ greatly in size. Sulcate forms do not gain the size of some that are only partially sulcate or are nearly or wholly smooth.

Measurement of shells:

Altitude	*Diameter*	
13½ mm.	11 mm.	Coosa River, Schowalter collection
10½	8¼	" " " "
16	11	Fort William Shoals, Talladega County
15½	11	" " " " "
14	11	" " " " "
10	8½	" " " " "
17	12	Peckerwood " " "
16½	12	" " " "
15	11	" " " "

Anculosa lirata H. H. Smith, new species

Fig. 22

Shell: Small, subglobose, in form much like a juvenile specimen of *A. griffithiana* Lea. Body whorl subangular, slightly indented over the umbilicus. The type has nine folds or ribs from suture to base, each of about the same size. The two uppermost folds are somewhat wavy, though no other indication of plicae exists. The longitudinal lines of growth are delicate, but distinct, being crossed by revolving lines; the sculpture having a silky appearance under the glass; this is particularly noticeable in the spaces between the folds. Color dark brown, somewhat mottled. Aperture ovate, having four continuous, equidistant bands. The columella is small, smooth, rounded, purple at the top, white from just above the center to the base. Apex eroded, only a part of the penultimate whorl remaining in addition to the body whorl. Suture not deeply impressed. Lip slightly crenulate, having only a suggestion of the furrows present in many individuals of *A. showalterii* Lea. The lip is not flaring.

Operculum: Thin, dark or rusty brown, about one-half as wide as it is high. Apex acute. Left margin curved, slightly thickened; right margin curved, thin, a little torn. Basal margin injured, but probably broadly rounded in a perfect state. The polar point is near the left margin. The spiral lines cannot be traced. The operculum differs from the opercula of *A. showalterii* Lea and *A. sulcata* Smith in being more nearly oval, more delicate.

Measurements: Altitude, 11½ mm.; diameter, 7½ mm. Aperture—altitude, 7 mm.; diameter, 3½ mm.

Type locality: Coosa River, Fort William Shoals, Talladega County, Alabama. Collected by Herbert H. Smith, June, 1913.

Type in the Museum of Zoology, University of Michigan; paratypes in the Alabama Museum of Natural History.

The type lot of *lirata* consists of three shells only. The species seems to represent a variation of *showalterii* Lea, smaller, more conic, more delicate of sculpture. It differs also in the operculum. The shell suggests a dwarfed *sulcata* Smith, but has a fewer number of folds and lacks the shouldered effect of the body whorl of that species. Connecting forms with *sulcata* appear in material from Three Island Shoals, above the type locality. From Wetumpka material in the Calkins collection, Mr. Smith has separated a shell very much like the type specimen of *lirata* and among Anculosae

collected by Call at the same place are about a half-dozen more shells of the same form. The locality seems to argue that these Wetumpka shells are depauperate forms of *griffithiana* Lea, and doubtless they are when one considers the appparently restricted habitat of the *showalterii* group. The question illustrates the variability of the Coosa River Pleuroceridae and the tendency of each species to develop forms resembling other species in the same locality.

In sculpture, all of the material is very much alike. The Three Island Shoals specimens differ in having larger folds or ribs than the Fort William Shoals specimens, these being also more widely spaced. One of the shells from Fort William Shoals is lighter in color than the type, one darker. One is without bands in the aperture, the other has bands which are interrupted, following the sides of the folds. The banding arrangement in the Three Island Shoals shells are after this pattern rather than that of the type.

Measurements:

Altitude	*Diameter*	
11 mm.	8 mm.	Fort William Shoals, Talladega County
10	7¼	" " " "
13	9	Three Island " " "
12	8½	" " " " "
11	8	" " " " "

Anculosa sulcata H. H. Smith, new species

Fig. 20

Shell: Rather heavy, subglobose, nearly as wide as it is high, slightly angled at the periphery and indented a little in the base, resembling *A. griffithiana* Lea in this regard. The type has fifteen strong, narrow ribs of varying size from suture to base. The first two ribs of the body whorl are at right angles to the whorl preceding, giving a decided shouldered effect to the shell. The large body whorl is covered with fine growth lines and these are crossed at places by revolving lines more or less undulate. Color light brown, shining. Three continuous bands show within the aperture, the uppermost being heavier than the other two. Apex eroded, only two whorls remaining. Suture irregularly impressed, almost channeled where the first rib of the body whorl rises above it. Peristome slightly curved, crenulate. Columella porcelain white, smooth, rounded, not so heavy as in several species of equal size. Aperture ovate, yellowish-white, translucent. The aperture is smooth to within one or two mm. of the peristome, thereafter furrowed.

Operculum: Dark, thin, in size 8½ mm. by 4½ mm. Apex rounded. The left margin is firm, the right margin fragile. Lines of growth fine. Polar point is close to the base of the left margin. Whorls three, the spiral lines loosely coiled. The area of attachment is long and narrow.

Measurements: Altitude, 19¼ mm.; diameter, 14½ mm. Aperture—altitude, 14¼ mm.; diameter, 7½ mm.

Type locality: Coosa River, Ten Island Shoals, St. Clair County, Alabama. Collected by Herbert H. Smith, October, 1914.

Type in the Museum of Zoology, University of Michigan; paratypes in that museum and the Alabama Museum of Natural History.

The species is apparently confined to the stretch of the Coosa River

between the shoals a little below Greensport, St. Clair County, and Peckerwood Shoals, near the southern end of Talladega County. Shells from Ten Islands Shoals, Lock 2, Hall's Island and "near the mouth of Upper Clear Creek" are very much alike. The Three Island Shoals material contains shells connecting *sulcata* with *lirata* and through that species with *showalterii*. This relationship is made plainer by the specimens from Fort William Shoals. The one shell taken at Peckerwood Shoals, while having folds, resembles the smooth forms of *showalterii* very much.

In the typical specimens, the ribs vary in size and distance apart. Individuals occur the ribs of which are so flattened that in rubbing the finger over the surface of the shell one scarcely feels the sculpture. A juvenile *sulcata* taken by Mr. Smith has only eight narrow, thin ribs, widely spaced. Another specimen has three strong folds at the shoulder and no more. However, such variation is rare. *Sulcata* is characteristically strongly ribbed. The microscopic sculpture is apparently present upon all shells. In the case of the partly smooth forms, this sculpture has a "cross-hatching" effect beautiful under the glass.

Ten different banding arrangements were observed, the usual arrangement being four continuous equidistant bands. Of 81 shells in one lot from Ten Island Shoals, 16 were without bands, 2 had bands upon the epidermis but not in the aperture, 61 had well-defined bands in the aperture and of these last 45 had the arrangement of four bands. In the transition lot from Three Island Shoals, the bands were broken, irregular, following the sides of the ribs and the channels between, the tops of the ribs having only the usual coloring matter of the epidermis. In the Fort Williams Shoals shells, the thin bands are continuous and appear in pairs. The folds of the dark Peckerwood Shoals shell have small, irregularly shaped deposits of coloring matter which show in the aperture as broken bands.

The columella of most typical *sulcata* is white to bluish-white, occasionally lead-colored above the center, sometimes purple throughout. In the transition forms the purple columella is common, the white comparitively rare. It would appear as if the juvenile shells of the typical forms had columellae more or less touched with purple, this being overlaid in the adult shell by deposits of pure white enamel. The color of *sulcata* ranges from the yellowish-brown of material from the upper river localities, through the mottled shells of Three Island and Fort William shoals to the mahogany-brown shell of Peckerwood Shoals.

The peristome of all the *sulcata* is very slightly curved, usually crenulate and rarely smooth-edged.

The nuclear whorls of *sulcata* are small for the genus, rather tightly coiled, smooth, elevated. The ribs begin to develop with the second whorl. In the case of a juvenile shell from Fort William Shoals, a carina appears at the top of the second whorl, this quickly taking on the appearance of a typical fold or rib. So far as can be judged from the greatly eroded specimens, the species does not acquire more than five whorls.

In only two opercula could the spiral lines be traced. This feature seems to consist of two and a quarter widely coiled whorls within the operculum.

In one case the lines were raised, rough, thickened. In the other the spirals were deeply incised and were much more plainly marked than the first example.

Measurements of paratypes:

Altitude	*Diameter*	
22½ mm	14½ mm.	Ten Island Shoals, St. Clair County
19½	14½	" " " " " "
19	13	" " " " " "
19½	13½	Hall's Island, Shelby County
17½	13½	" " " "
17	11½	" " " "
19½	13½	Lock 2, St. Clair County
19½	13	" 2, " " "
16½	11½	" 2, " " "
16½	12	Three Island Shoals, Talladega County
15	12	" " " " "
15½	12	Fort William " " "
18	13	Peckerwood " " "
15	11½	Coosa River, Schowalter collection

Anculosa occultata H. H. Smith, new species

Fig. 21

Shell: Subglobose, the most Neritina-like of all the Anculosae. Thin. Growth lines very delicate, regular, close together. A few revolving striae appear on parts of the shell, are very obscure and do not continue around the whorl. Apex eroded, body whorl very large, broadly rounded at the shoulder, almost flattened, lacks folds or plicae. Suture not very deeply marked. Peristome thin, but firm, straight, flaring so that the aperture is practically round. Columella regularly curved, broadly flattened on top, the inner edge almost sharp; bluish-white with spot of purple at the top, its junction with the peristome lacking the deposit of callous which fills this area in several other species of the genus. Color of shell brown, with four very dark continuous bands.

Operculum: Thin, red, elongate, apex and basal margin rounded. Growth rays very fine. A few obscure waving lines appear close to and parallel with the right margin. The polar point is placed on the left margin near the base. The spiral lines cannot be made out in entirety, but appear to be widely coiled, as in the operculum of *A. sulcata.*

Measurements of type: Altitude, 11 mm.; diameter, 8¾ mm. Aperture—altitude, 6½ mm.; diameter, 6¼ mm.

Type locality: Coosa River, Duncan's Riffle, Chilton County, Alabama. Herbert H. Smith, collector.

Type in the Museum of Zoology, University of Michigan; paratypes in this museum and the Alabama Museum of Natural History.

The localities in which this species has been collected are Duncan's Riffle, Higgin's Ferry, The Bar, Butting Ram Shoals and "near the mouth of Yellowleaf Creek," all in the Coosa River and within the reaches touching Chilton and Coosa counties.

Most of the shells, including the young, have the Neritina-like form, a few only being found in this collection which are conic as in the case of the juvenile of *brevispira* Smith, which in a way this species resembles.

The sculpture is confined to the fine growth lines and occasional indications of revolving striae. Color varies from yellow to dark brown. In many of the shells the bands are so dark and broad that the ground color of the epidermis shows only as narrow lines. The bands are continuous or interrupted, the formula of four equidistant bands prevailing. Of 125 specimens in one lot from the Higgin's Ferry locality, 111 had the four bands; 2 had five bands; 7 had modified arrangements of the four-banded formula; 5 were without bands. No variation was observed as between localities.

The flattening of the columella was more pronounced in the material from the type lot than in most of the other shells. This, however, is a fairly constant characteristic and is so marked in some specimens as to give them an excavated appearance, this being occasionally heightened by the erosion of the body whorl over the umbilical region. The color of the columella is usually purple, though white is not uncommon. The peristome sometimes has a slight curve close to the suture.

The embryo *occultata* is very small, the apex raised or flattened, loosely coiled, smooth, consisting of one and one-half whorls. In many of the juveniles the peristome is raised at the top above the plane of the apex and the bulk of the shell matter is so crowded into the upper half that the lower half of the shell is made up mostly of a thin columella and a flaring outer lip. This last character is suggestive of *Ncoplanorbis smithi* Walker.

Measurements:

Altitude	*Diameter*	
13 mm.	10 mm.	Higgin's Ferry, Chilton County
12½	9	" " " "
12	9½	" " " "
10½	8	" " " "
11	8¼	The Bar, Chilton County
11½	7½	Butting Ram Shoals, Coosa County

Anculosa compacta (Anthony)

Fig. 27

Melania compacta Anth., *Annals N. Y. Lyceum Nat. Hist.*, Vol. VI, p. 123, pl. iii, fig. 22, April, 1854.

Lithasia nuclea Lea, *Proc. Acad. Nat. Sci., Phila.*, XII, p. 188, 1860.

A note by Mr. Smith among his labels reads: "This is the *M. compacta* Anth., *Lithasia nuclea* Lea, *Lithasia compacta* of Tryon and later authors. Certainly not a Lithasia, and that genus has not been found in the Alabama drainage, though several species are incorrectly referred to it. I think that *compacta* is an Anculosa, allied to *A. vittata* Lea. A variety or closely allied species lives in the Warrior."

The judgment of Mr. Smith appears sound. Lea in his description of *nuclea* notes the similarity to Anculosa. It is strange that Tryon should have recognized *compacta* as a Lithasia while placing the allied *melanoides* Conrad of the Black Warrior among the Anculosae.

Though Lea's *nuclea* is credited to the Coosa River there is good reason for believing that the species is confined to the Cahaba River and its tributaries. Lea received his material from Dr. Schowalter, and all the *compacta* which have been found in the Schowalter collection are assigned to the Cahaba.

The sculpture of *compacta* consists simply of fine growth lines, often worn nearly smooth. No revolving lines can be made out with a glass of ordinary power. Color varies from yellow to dark brown. Green shells, especially among the juveniles are fairly common. Bands, where they appear, are three in number, equidistant, varying slightly in width and depth of coloration. Only one banded specimen was found which differed from this formula, the variation consisting merely of the absence of the basal band. The two shells collected by Mr. Smith in the Cahaba at Henry Ellen were without bands. Of one lot of four specimens from Lily Shoals, one only was without bands. In the second lot from this locality, 85 had bands, 26 were without them.

The columella of *compacta* is small, smooth, rounded, angulated at the center rather than rounded. A callous just below the turn is sometimes sufficiently heavy so as to suggest a "tooth". In color the columella is usually white, often marked with purple or red. The Calkins lot has 4 specimens with white columellae; 3 the columellae of which are entirely purple; 5 with the columella part white, part a faded purple. In the larger Lily Shoals lot, white is the predominant color

The form of the species varies slightly. The periphery is frequently subangulated, far more often rounded. A few have the constriction of the body whorl so characteristic of *A. ligata*. In one lot, several specimens have the narrowed aperture and produced peristome of the species known as *Goniobasis louisvillensis* Lea, which is probably a Lithasia. Shells with the apex entire are wholly absent from this collection, but from specimens only partly eroded six whorls for a fully grown *compacta* are indicated.

A form of the species from Buck Creek, a tributary of the Cahaba in Shelby County, is light yellow, flat of whorls, almost pyramidial and without bands. This creek form is exceedingly puzzling because of its resemblance to *Goniobasis germana* Anth. and close study is required to separate the two. This is another illustration of the meager barrier which separates some of the genera of the Pleuroceridae.

The operculum is small, thin, ovate, red. Growth lines and rest scars are rather heavy. Apex rounded, the right and left margins about equally curved. The right margin is thin, the left margin firm. The polar point is very small and near the base of the left margin. The whorls within the body of the operculum are closely coiled, and in the specimen illustrated the total number of whorls is four—an irregularity comparable with an instance occuring in *picta*. Compared with the operculum of *melanoides*, that of this species is darker, heavier, more ovate, the growth lines heavier, the polar point more distinct. Judged by the opercula, the relationship between *vittata* and *melanoides* is closer than the connection between either of these species and *compacta*.

Measurements of shells:

Altitude	*Diameter*						
16¼ mm.	9¼ mm.	Cahaba River, Aldrich collection					
14	8½	"	"	"	"		
13	8	"	"	"	"		
12	7¾	"	"	"	"		
14½	8¼	"	"	Calkins collection			
14	8	"	"	"	"		
11	7½	"	"	Henry Ellen, Jefferson County			
12½	7¾	"	"	Lily Shoals, Bibb		"	
12	8	"	"	"	"	"	"
11¼	8½	"	"	"	"	"	"

Anculosa melanoides (Conrad)

Fig. 28

Anculotus melanoides Conrad, *New Fresh Water Shells of U. S.*, p. 64, 1834.
Anculosa turgida Hald., Supplement to No. 1, *Monog. Limniades*, Oct. 1840.

Conrad's description of *melanoides*, like most of the other early descriptions of the Pleuroceridae, is indefinite and incomplete. The diagnosis might fit many other species of the family. The locality given, "inhabits rivers in North Alabama," also lacks definiteness. The foregoing comments apply as well to Haldeman's *turgida*. In the absence of type specimens and a clear description, reliance is placed upon Tryon's identifications and his illustration in recognizing the smaller of the two Black Warrior Anculosae as the true *melanoides*, and upon Tryon again for putting *turgida* down as a synonym.

The uniformity in the size and proportions of this species would seem to indicate that it is one of the older members of the Pleuroceridae, having passed through the era of variability and plasticity and become suited to a varying environment. That it is perhaps a vanishing race might be assumed from the apparently narrow range and the smallness of its numbers. Its competitor, *plicata*, is seemingly far more common and in numbers of individuals exceeds it as in the Ohio River *A. praerosa* exceeds the small *A. costata* and possibly *A. trilineata*.

The sculpture of *melanoides* is confined to fine growth lines which in most specimens, not in all, are crossed by faint, discontinous revolving lines. There are no nodules, tubercules or striae. Upon the adult specimens, the only ones at hand, there occur no carinae. The rest scars are dark and delicate.

The body color varies from yellow to brown, with occasional specimens of a greenish tinge. Yellow bandless forms are so smooth that they shine as if varnished. The number of banded specimens is to unbanded individuals as three to four. Only two banding arrangements were remarked—(1) band at suture and at base; (2) band at suture, periphery and base. The ratio of form 2 to form 1 is five to one.

The columella forms an angle at its center rather than a curve, being

virtually straight from center to base, and at the base slightly reflected. A minute projection or curve at the center of the columella suggests an incipient "tooth," and it is this character possibly which caused Haldeman to liken *turgida* to the Atlantic drainage *A. dissimilis* Say. In color the columella is white, pinkish or reddish; in one specimen it is purple throughout. The peristome is very slightly curved and is bordered with black.

The whorls are flat, the body whorl being subangular. No uneroded shells appear in the Smith collection, but one or two individuals which retain parts of the upper whorls give indication that the spire of *melanoides* is smooth or, in instances, delicately touched with incomplete revolving lines. The maximum number of whorls is probably six.

The operculum is very thin, translucent and yellow-brown in color. The growth lines are regular, somewhat wavy in places and, by transmitted light, these are seen to be crossed by exceedingly fine curving lines from the basal margin to the left margin below the apex. The margins are ragged, even the thickened left margin being torn in some specimens. The polar point normally rests upon the left margin. The spiral development could not be traced.

Mr. Smith appears to have had doubts as to *melanoides* being a true Anculosa. It is one of the border species such as link different genera of this family together, and it might be a matter of personal choice as to where the naturalist shall place it. The nearest relative is *Melania compacta* Anth., of this group, which Tryon placed under Lithasia and which Mr. Smith, in his notes and labels, pronounces no Lithasia at all. The operculum links up *melanoides* with *vittata* more closely than with *compacta*. Until clearly defined anatomical distinctions are discovered, the proper grouping of these shells will remain in question and any argument which could be raised over shell characters of border species alone would represent futile expenditure of breath.

Measurements:

Altitude	*Diameter*	
13 mm.	7½ mm.	Warrior River, Alabama
11	7	" " "
10½	6½	" " "
10	7	" " "
10	6	" " "
9½	5½	Tuscaloosa, Alabama
9	5	" "
8	5	" "

Anculosa vittata Lea

Fig. 29

Anculosa vittata Lea, *Proc. Acad. Nat. Sci., Phila.*, xii, p. 188, 1860.

This species was described by Dr. Lea as from the Coosa River at Wetumpka. Mr. Smith does not seem to have found it there. As there are no specimens in the Schowalter collection it is highly probable that the occurance of *vittata* in this locality is extremely rare and that the few shells of Dr. Schowalter's finding passed out of his hands. Thirty or forty miles north, however, where the Coosa borders Chilton County Mr. Smith found the species in quantity, his three localities for *vittata* being The Bar, Higgin's Ferry and Duncan's Riffle. A note with the lot from The Bar reads "swift water."

Considering the variability of most of the Anculosae of the Coosa, the characters of *vittata* are remarkably constant. The sculpture consists of very fine, hair-like lines of growth and occasional revolving lines which are noticeable only near the suture. These latter lines on the upper whorls of a few specimens are strong enough to suggest carinae. The rest scars, in keeping with the sculpture mentioned, are unusually delicate.

The color varies from yellow to rusty brown, the shells being dull rather than shining. The prevailing arrangement of the well-marked bands is a band hugging the suture, a band at the base and two bands, rather close together, at the periphery. Nine other arrangements were noted in this study, but they are all modifications of the prevailing formula.

The columella is very flat, broad, the outer edge raised above the body whorl. This edge is crescent-shaped as viewed from the side. The inner margin is slightly angled at the center rather than curved, and it here has the mere suggestion of a tooth as in *A. melanoides* Conrad, this character being more pronounced in material from The Bar than elsewhere. The columella is white to bluish-gray, in some specimens purple. The peristome is sharp-edged, firm, usually straight or having only a slight curve close to the suture.

It would appear that *vittata* is not as much exposed to erosion as most of the Anculosae, for entire specimens occur in this material much more than in others. The nuclear whorls are tightly to loosely coiled, smooth, elevated. The development of the shell is so regular that it is impossible to discover the dividing line between the embryo whorls and those which follow. So far as Mr. Smith's collection shows, the adult has not to exceed four and one-quarter whorls.

The operculum is very small, oval, thin, transparent, yellow to brown. The left margin is firm and curved only slightly less than the thin and torn right margin. The basal margin is worn and irregular as if from rubbing against the columella. The polar point is scarcely more than an indentation at the base of the left margin. The spiral development does not show up even under a fairly strong glass. Growth lines are light. In most opercula of this genus, the area of attachment occupies as a rule not more than one-half of the operculum. In the case of *vittata* it appears to involve

virtually the whole of the operculum. This suggests that in this species the operculum is becoming decadent—an assumption supported perhaps by its smallness and thinness.

Shell measurements:

Altitude	*Diameter*	
7½ mm.	6 mm.	The Bar, Chilton County
7¼	5½	" " " "
6½	5	" " " "
8	6	Higgin's Ferry, Chilton County
7¾	6½	" " " "
7	5	" " " "
6½	4½	" " " "
7	5	Duncan's Riffle, " "
6	4½	" " " "

Anculosa ligata Anthony

Fig. 30

Anculosa ligata Anth., *Proc. Acad. Nat. Sci., Phila.*, Feb. 1860, p. 67.

This species is apparently confined to the last seventy-five or one hundred miles of the Coosa River. Shells from the following localities are in the collection brought together by Mr. Smith:

Weduska Shoals and near the mouth of Waxahatchee Creek, Shelby County; near the mouth of Yellowleaf Creek, Cedar Island, Higgin's Ferry and The Bar, Chilton County; Butting Ram Shoals, Coosa County; Wetumpka, Elmore County. In the Schowalter collection, Mr. Smith found *ligata* in material from Buck Creek, Shelby County, which is in the Cahaba drainage. Mr. Smith's label indicates that he doubts the occurrence of the species in this stream. The specimens had probably been misplaced.

Judging from the numbers of shells taken at the different stations, the species flourishes most prosperously on the Weduska Shoals and in the shallows of The Bar. Only two specimens were taken at Wetumpka.

The constriction of the body whorl which suggested to Anthony the name *ligata* is present on all the shells examined. It is sometimes not pronounced, as in the case of the shells from near the mouth of Waxahatchee Creek; sometimes almost channeled, as in shells from Weduska Shoals. No folds or ribs are present and the only features in the nature of plicae or tubercules are irregular nodes near the suture, present only rarely. Striae parallel with the peristome are crossed by fine lines, usually continuous, which are often wavy. Under the glass, the epidermis has the appearance of woven linen. The revolving lines are best shown by half-grown individuals and are stronger near the suture than upon the base of the shell.

Seven different banding arrangements were observed, the usual one being a heavy band at the suture, at periphery and upon the base. The ratio of banded specimens to unbanded is about five to one. Though ordinarily the bands upon the epidermis are broken into squares, within the aperture these bands are usually continuous. In only two specimens does the coloring matter of the bands coalesce so as to darken the aperture.

The columella is light for Anculosa. It is slightly angulated at the center as in *A. compacta* Anth. It is sometimes porcelain white or bluish white, more often stained pink or red. It was noticed in material from Butting Ram Shoals that the shells with a white columella were old. The lip is curved as in *A. praerosa* Say. This curved lip in the case of some specimens gives the suggestion of the fissure of Gyrotoma. The peristome is thin, firm, and in the instance of some old shells it is slightly thickened with callous. The aperture is white, blue-white, reddish, and in some shells yellowish. The color of *ligata* from near the mouth of Waxahatchee Creek is chestnut brown; the Weduska Shoals shells, olive to dark brown; those from The Bar, light to rusty brown. Anthony's shells were dark green. This is a rare color among Mr. Smith's specimens.

The nuclear whorls of *ligata* are raised, smooth, apparently consisting of one and one-half whorls—the line between the embryo shell and the following whorl being hard to make out. The suture is almost channelled on the first two whorls of *ligata*. The typical "cross-hatch" sculpture begins to show upon the third whorl. The periphery of most of the juvenile shells is flattened. The extreme number of whorls of this species is probably five or six.

The operculum is almost oval, dark brown, rather thick, leathery. Edges of both left and right margins are thickened. Lines of growth are coarse, those on the basal margin extending into four to seven stout, thorn-like serrations, curving to the left. The polar point is deeply sunken and is located on the left margin close to the base. The spiral development is obscure, but in one specimen examined the two whorls within the operculum could be traced.

The salient features of *ligata* are the constricted body whorl, the textile-like microscopic sculpture and the hooked processes of the basal margin of the operculum.

Measurements:

Altitude	*Diameter*	
13½ mm.	8½ mm.	Coosa River, Schowalter collection
12½	8½	" " " "
12	8½	" " " "
14½	10½	Weduska Shoals, Shelby County
14	9	" " " "
13½	9½	" " " "
16½	10	Butting Ram Shoals, Coosa County
15	10	" " " " "
16	11	The Bar, Chilton County
15	10½	" " " "
13	9	" " " "
13	9½	Wetumpka, Elmore County
11	8½	" " "

SPURIOUS SPECIES

Anculosa pumilus Conrad, *New Fresh Water Shells of U. S.*, p. 62, 1834.

This is a Somatogyrus.

Anculosa flammata Lea, *Proc. Amer. Phil. Soc.*, II, p. 243, December, 1843.

Description was from a single specimen and was based principally upon a pathological condition in which the coloring matter of bands or lines is deposited longitudinally. Frequently a shell of this kind has bands or lines as well. Several species in the Alabama collection have occasional *flammata* specimens. They are most common in the *picta* group and it is to this group that Lea's species appears to belong, though just to which one it cannot here be said.

Anculosa incisa Lea, *Proc. Amer. Phil. Soc.*, II, p. 243, 1843.

This is *Gyrotoma incisa* Lea.

Anculosa solida Lea, *Proc. Amer. Phil. Soc.*, II, p. 243, 1843.

According to Tryon this equals *Lithasia brevis* Lea, described at the same time.

Anculosa squalida Lea, *Proc. Amer. Phil. Soc.*, IV, p. 167, 1845.

Nothing among Mr. Smith's collections corresponds to the Lea description and Tryon's figure with exactness, and Mr. Smith himself does not appear to recognize it. The type locality is Tuscaloosa, which is on the Black Warrior. The only Anculosa of the size of *squalida* which is known from that stream is *plicata*, described by Conrad in 1834. Lea's figure and Tryon's are of quite different shells and, seemingly, different genera.

Anculosa contorta Lea, *Proc. Acad. Nat. Sci., Phila.*, XII, p. 187, 1860.

No material which can be ascribed to this species appears in the Alabama collection. It was described from one specimen, taken by Dr. Schowalter. It is in all likihood a deformed individual.

Anculosa planulata Lea, *Wheatley Cat. Shells*, p. 28, Alabama; description not published.

Tryon seems to think this equals *A. ampla* Anth.

A mollusk named by Anthony *Melatoma sphaericum* (Reeve Monog., sp. 8, 1861) and recognized by Tryon as a Schizostoma (Gyrotoma) is evidently an Anculosa, probably belonging to a described species of the *picta* group.

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PLATE I

ANCULOSA

Figure 1. *A. aldrichi* H. H. Smith. Type. Coosa River, near mouth of Yellowleaf Creek, Chilton County. (Cat. No. 10139.)

Figure 2. *A. aldrichi* H. H. Smith. Paratype. (Cat. No. 10138.)

Figure 3. *A. ampla* Anth. Lily Shoals, Cahaba River. (Cat. No. 10140.)

Figure 4. *A. ampla* Anth. Coosa River, Wetumpka. (Cat. No. 10142.)

Figure 5. *A. ampla* Anth. Lily Shoals, Cahaba River, Ala. (Cat. No. 10140.)

Figure 6. *A. brevispira* H. H. Smith. Type. Coosa River, Ft. William Shoals, Talladega County. (Cat. No. 10144.)

Figure 7. *A. choccoloccoensis* H. H. Smith. Type. Choccolocco Creek, Talladega County. (Cat. No. 10145.)

Figures 8 and 9. *A. clipeata* H. H. Smith. Type. Coosa River, Ft. William Shoals, Talladega County. (Cat. No. 10146.)

Figure 10. *A. clipeata* H. H. Smith. Paratype. (Cat. No. 10147.)

Figures 11 and 12. *A. compacta* Anth. Lily Shoals, Cahaba River. (Cat. No. 10149.)

Figures 13 and 14. *A. coosaensis* Lea. Coosa River, Ft. William Shoals, Talladega County. (Cat. No. 10150.)

Figure 15. *A. downiei* Lea. Coosa River, near Cedar Bluff, Cherokee County. (Cat. No. 10152.)

Figure 16. *A. downiei* Lea. Coosa River, near Cedar Bluff, Cherokee County. (Cat. No. 10152.)

Figure 17. *A. flexuosa* H. H. Smith. Type. Coosa River, Wetumpka. (Cat. No. 10154.)

Figure 18. *A. foremani* Lea. Coosa River, Ft. William Shoals, Talladega County. (Cat. No. 10157.)

Figure 19. *A. foremani* Lea. Coosa River, The Bar, Chilton County. (Cat. No. 10158.)

Figure 20. *A. formosa* Lea. Coosa River, Ft. William Shoals, Talladega County. (Cat. No. 10159.)

Figure 21. *A. griffithiana* Lea. Coosa River, Wetumpka. (Cat. No. 10165.)

Figure 22. *A. griffithiana* Lea. Coosa River, The Bar, Chilton County. (Cat. No. 10166.)

Figures 23 and 24. *A. ligata* Anth. Coosa River, The Bar, Chilton County. (Cat. No. 10167.)

Figure 25. *A. lirata* H. H. Smith. Type. Coosa River, Ft. William Shoals, Talladega County. (Cat. No. 10168.)

Figure 26. *A. melanoides* Conrad. Black Warrior River. (Cat. No. 10169.)

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PLATE II

ANCULOSA

Figures 27 and 28. *A. mimica* H. H. Smith. Type. Little Cahaba River, Bibb County. (Cat. No. 10170.)

Figures 29 and 30. *A. modesta* H. H. Smith. Type. Coosa River, Riddle's Bend, Cherokee County. (Cat. No. 10172.)

Figures 31, 32, and 33. *A. occultata* H. H. Smith. Type. Coosa River, Duncan's Riffle, Chilton County. (Cat. No. 10173.)

Figure 34. *A. picta* Conrad. Alabama River, Selma. (Cat. No. 10175.)

Figure 35. *A. picta* Conrad. Coosa River, Wetumpka. (Cat. No. 10176.)

Figure 36. *A. plicata* Conrad. Forks of Black Warrior River, Walker County. (Cat. No. 10179.)

Figure 37. *A. plicata* Conrad. Near Lock 15, Black Warrior River. (Cat. No. 10177.)

Figure 38. *A. plicata* Conrad. Black Warrior River, Tuscaloosa. (Cat. No. 10178.)

Figures 39 and 40. *A. showalterii* Lea. Coosa River, Ala. From the Schowalter Collection. (Cat. No. 10180.)

Figures 41 and 42. *A. showalterii* Lea. Coosa River, Peckerwood Shoals, Talladega County. (Cat. No. 10181.)

Figures 43 and 44. *A. smithi* Goodrich. Type. Valley Creek, Toadvine, Jefferson County. (Cat. No. 10183.)

Figure 45. *A. sulcata* H. H. Smith. Type. Coosa River, Ten Island Shoals, St. Clair County. (Cat. No. 10184.)

Figures 46 and 47. *A. taeniata* Conrad. Coosa River, Ten Island Shoals, St. Clair County. (Cat. No. 10188.)

Figure 48. *A. taeniata* Conrad. Coosa River, Ft. William Shoals, Talladega County. (Cat. No. 10187.)

Figure 49. *A. taeniata* Conrad. Coosa River, The Bar, Chilton County. (Cat. No. 10186.)

Figure 50. *A. torrefacta* H. H. Smith. Type. Coosa River, Weduska Shoals, Shelby County. (Cat. No. 10189.)

Figure 51. *A. torrefacta* H. H. Smith. Paratype. Coosa River, Weduska Shoals, Shelby County. (Cat. No. 10190.)

Figure 52. *A. vittata* Lea. Coosa River, The Bar, Chilton County. Cat. No. 10191.)

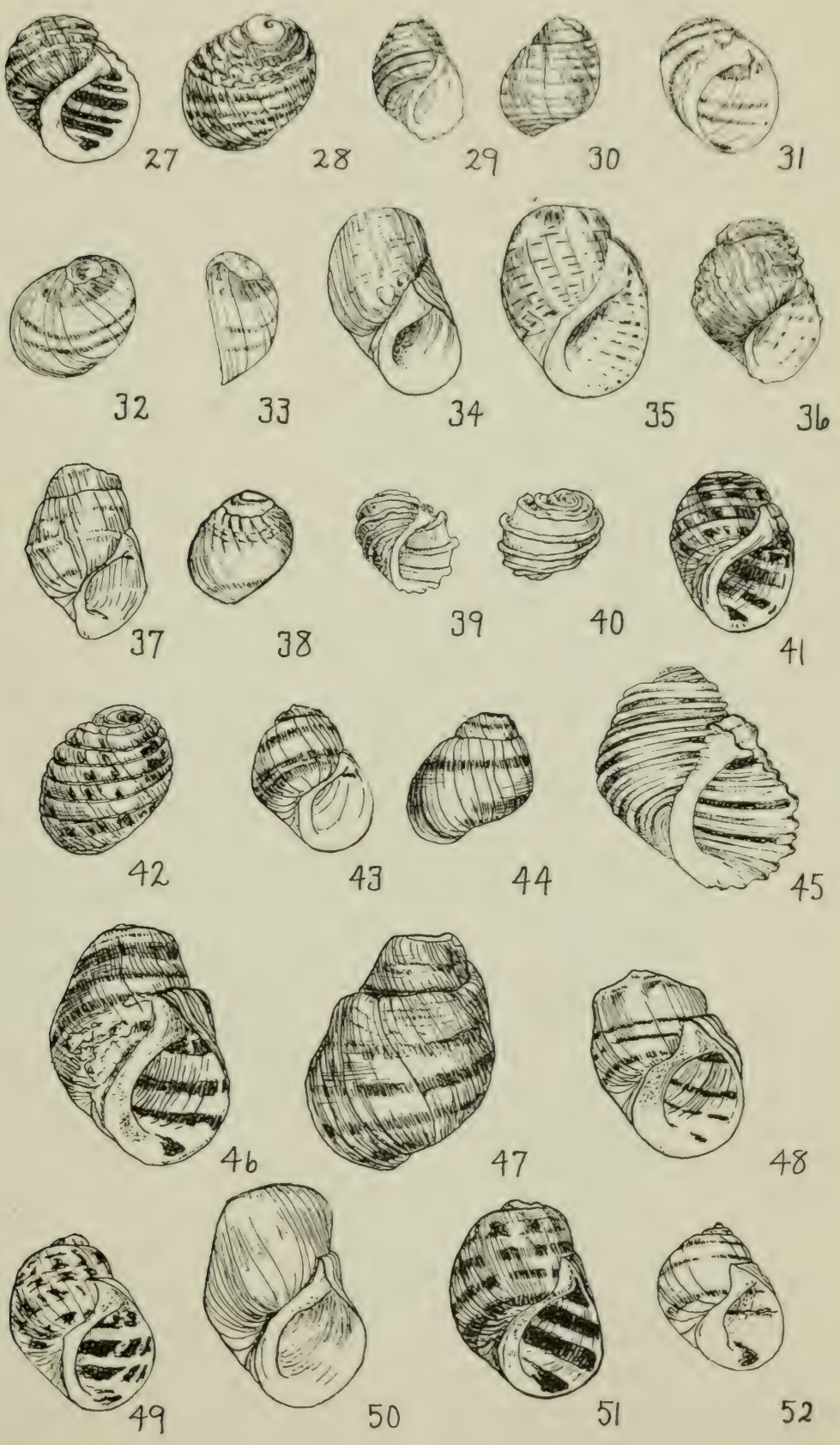
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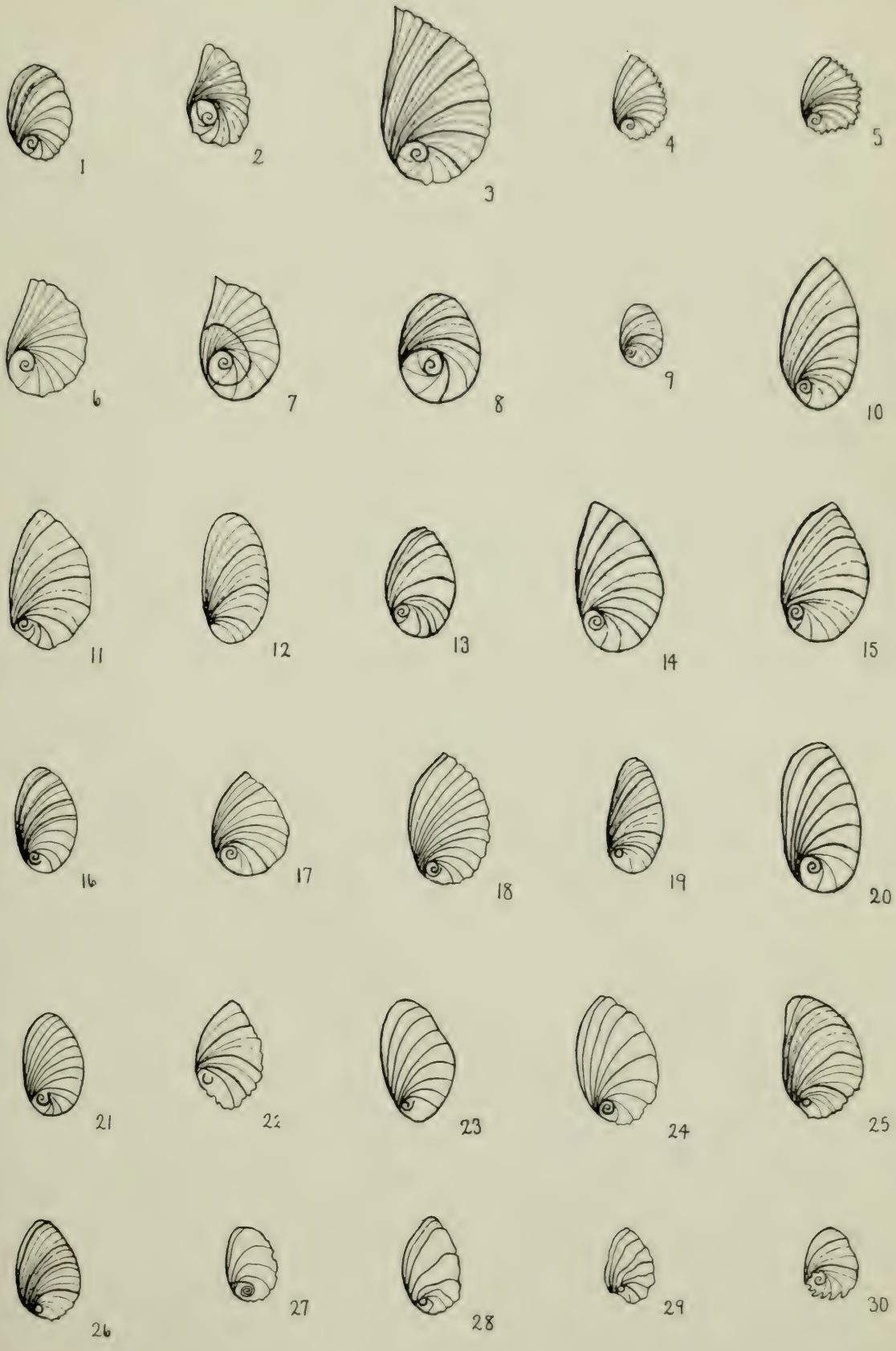
PLATE III

Opercula

Figs. 1, 2 *Anculosa downiei* Lea.
Fig. 3 " *formosa* Lea
Figs. 4. 5 " *foremani* Lea.
Figs. 6, 7 " *picta* Conrad.
Fig. 8 " *clipeata* H. H. Smith.
Fig. 9 " *modesta* H. H. Smith.
Fig. 10 " *taeniata* Conrad.
Fig. 11 " *torrefacta* H. H. Smith.
Fig. 12 " *brevispira* H. H. Smith.
Fig. 13 " *coosaensis* Lea.
Fig. 14 " *choccoloccoenis* H. H. Smith.
Fig. 15 " *griffithiana* Lea.
Fig. 16 " *aldrichi* H. H. Smith.
Figs. 17, 18 " *flexuosa* H. H. Smith.
Fig. 19 " *showalterii* Lea.
Fig. 20 " *sulcata* H. H. Smith.
Fig. 21 " *occultata* H. H. Smith.
Fig. 22 " *lirata* H. H. Smith.
Fig. 23 " *ampla* Anthony.
Fig. 24 " *mimica* H. H. Smith.
Fig. 25 " *plicata* Conrad.
Fig. 26 " *smithi* Goodrich.
Fig. 27 " *compacta* Anthony.
Fig. 28 " *melanoides* Conrad.
Fig. 29 " *vittata* Lea.
Fig. 30 " *ligata* Anthony.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GEOLOGICAL SURVEY OF ALABAMA

EUGENE ALLEN SMITH, State Geologist

MUSEUM PAPER No. 7

Alabama Museum of Natural History

The Genus Gyrotoma

BY

CALVIN GOODRICH

Published in Co-operation with the Museum of Zoology,

University of Michigan.

1924

EXPLANATORY NOTE.

This paper, like Museum Paper No. 6, on the genus *Anculosa*, published in 1922, is the work of Mr. Calvin Goodrich of Detroit, Mich., and was issued originally by the University of Michigan, as one of the Miscellaneous Publications of the Museum of Zoology. Like the former paper, it is based almost entirely on specimens collected by Herbert H. Smith and deposited in the Alabama Museum of Natural History.

Mr. Smith began systematic collecting of the aquatic shells of the family Pleuroceridae in the Coosa River and its tributaries in the fall of 1904, for a group of four conchologists, Hon. Truman H. Aldrich of Birmingham, Mr. George H. Clapp of Pittsburgh, Dr. Henry A. Pilsbry of the Philadelphia Academy of Natural Sciences, and Mr. Bryant Walker of Detroit. Later Mr. John B. Henderson, of Washington, took Dr. Pilsbry's place in financing the work.

Early in the fall of 1908 Mr. Smith came to the University of Alabama at the request of Mr. Walker, to study the fresh-water shells of the Schowalter collection in our museum. Shortly afterward he accepted the position of curator of the Museum, which he retained until his death (March 22, 1919).

In studying the shells collected by Mr. Smith in Alabama and elsewhere for the above mentioned group of conchologists, Mr. Clapp took the land shells, Mr. Walker the fresh-water shells other than Pleuroceridae, and Dr. Pilsbry the Pleuroceridae at first. Pressure of other work soon made it necessary for Dr. Pilsbry to drop out, and Mr. Smith took over the Pleuroceridae, in which he had long been specially interested.

After Mr. Smith's death, at the suggestion of Dr. Walker, our specimens of *Anculosa* and *Gyrotoma*, with Mr. Smith's notes on them, were turned over to Mr. Goodrich, who was making a study of that family. It is his intention to work over some of the numerous other genera in a similar manner as soon as possible.

The results of his painstaking investigations appear in this pamphlet and the one on *Anculosa* previously published. Lack of funds made it impracticable for the Geological Survey of Alabama to assume the whole expense of printing, as was done with papers on birds, amphibians and reptiles issued in the last few years, but through the kind offices of Dr. Walker these two papers have been published first by the University of Michigan. Five hundred extra copies of each were run off for us at nominal expense, and are distributed under our own covers. For this arrangement our sincere thanks are due to the University of Michigan, and to Dr. Walker and Mr. Goodrich.

Gyrotoma is a genus of fresh-water shells, with about 13 valid species (two of which were discovered by Mr. Smith, and are here described for the first time, using the names he gave them), wholly confined, as far as known, to the shoals of the Coosa River, from "Lock 2" in St. Clair County down to Wetumpka. These shells have been found only in the main stream, and not even in any of the tributaries. Unfortunately many of the shoals have been flooded by dams for power or navigation in recent years, so that some of the species must now be extinct.

November, 1924.

EUGENE A. SMITH,
State Geologist.

UNIVERSITY OF MICHIGAN
MUSEUM OF ZOOLOGY

Miscellaneous Publications No. 12

The Genus Gyrotoma

BY

CALVIN GOODRICH

Published in Co-operation with the Geological Survey of Alabama

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ANN ARBOR, MICHIGAN
PUBLISHED BY THE UNIVERSITY
FEBRUARY 23, 1924

ADVERTISEMENT

The publications of the Museum of Zoology, University of Michigan, consist of two series—the Occasional Papers and the Miscellaneous Publications. Both series were founded by Dr. Bryant Walker, Mr. Bradshaw H. Swales and Dr. W. W. Newcomb.

The Occasional Papers, publication of which was begun in 1913, serve as a medium for the publication of brief original papers based principally upon the collections in the Museum. The papers are issued separately to libraries and specialists, and, when a sufficient number of pages have been printed to make a volume, a title page, index, and table of contents are supplied to libraries and individuals on the mailing list for the entire series.

The Miscellaneous Publications include papers on field and museum technique, monographic studies and other papers not within the scope of the Occasional Papers. The papers are published separately, and, as it is not intended that they shall be grouped into volumes, each number has a title page and, when necessary, a table of contents.

Alexander G. Ruthven,
Director of the Museum of Zoology,
University of Michigan.

THE GENUS GYROTOMA

By Calvin Goodrich

The genus Gyrotoma has received no systematic treatment in fifty years. Since 1873, when Tryon's monograph was published, three collectors, T. H. Aldrich, A. A. Hinkley and H. H. Smith have taken many hundred times more specimens than were available for study by the naturalists who described the species. For the present inquiry I have examined material from several sources. The collection made by Mr. Smith and now in the Alabama Museum of Natural History is unrivaled, and, because of the water-power development in the Coosa River, flooding the shoals in which Gyrotomae live, it can probably never be duplicated. Acknowledgments are due to the Alabama Museum, the U. S. National Museum, Dr. Bryant Walker and Miss Mina Winslow. Without their aid this work could not even have been attempted.

The Record

Dr. Isaac Lea was the first descriptive naturalist to receive specimens of Gyrotoma. These he described as *Melania excisa* and *Anculosa incisa,* suggesting at the same time the generic term Schizostoma. When later he found the name already in use for a fossil he changed it to Schizochilus. In the meanwhile Shuttleworth had defined his genus. The fossil Schizostoma as well as the Schizostoma of Lea finally were forced into the synonymy. The good doctor, one of whose picturesque qualities was tenacity of purpose coupled with a certain fervid plausibility, sought to dig his original name out of its grave. The canons of nomenclature do not allow for cases of resurrection, and Gyrotoma has had to stand as the true generic designation.

Lea's specimens were sent to him by Dr. B. W. Budd. Because these shells were few in numbers, the condition of many of them that of drift material, their place of origin confused, and because Dr. Budd was himself interested in conchology and hardly likely to take ten or twenty shells where he might have gathered thousands, it is improbable that he was the collector. About the same period, Gyrotomae came to Mighels and apparently from the same correspondent. This was 1841, possibly 1842, to 1845. All the forms were of the Wetumpka aspect. In July, 1845, Shuttleworth described two species. His specimens had been collected by Rugel, who apparently visited the Coosa River at Greensport or thereabouts and may have gone as far down as Childersburg. It was not until 1904, when Mr. H. H. Smith began to explore the Coosa systematically, that Shuttleworth's one "good" species was found by an American collector. This history is an illustration of the casual, one might say accidental, collecting of early-day zoology in America.

About fifteen years after Dr. Budd's sendings, Gyrotomae, from the reaches between the Yellowleaf Creek of Shelby County and Fort William Shoals, Talladega County, were taken by Dr. Schowalter of Uniontown, Alabama. It would seem that Dr. William Spillman of Columbus, Mississippi, visited the Coosa River in the same places and at about the same time, and it is possibly fair to infer that the two were together. Lea and Anthony erected eighteen species from this new material and Reeve described still others under names supplied by Anthony.

Reeve's monograph of Melatoma appeared in 1860-61. Swainson had established Melatoma as a subgenus of Melanopsis Lam. Reeve believed it to be the same as Gyrotoma. Tryon says that Melatoma "is actually an exotic marine shell." The connection of Anthony's name with Melatoma was an error. Reeve's illustrations are excellent and in most instances the species can be recognized from these pictures. But the descriptions, written by Reeve, convey little information of value. In two of the descriptions no mention is made of the fissure, the distinctive character of Gyrotoma. In the case of one species the slit is described as "small, almost obsolete"; in one as "slightly channelled"; in two, "moderate"; in two, "broad"; in ten, "deep"; in two, "rather deep"; in one, "very deep." The reader of Reeve is reminded of the childhood question, "How deep is a well and how long is a string?"

The Anthony types described in this monograph are in the Museum of Comparative Zoology at Cambridge, Massachusetts. Reeve's own types are in the British Museum and these were examined by Dr. Bryant Walker and compared with material taken by Mr. Smith.

In 1862 Brot issued a "Catalogue Systematique des Especes qui Composent la Famille des Melaniens." He spoke about the genus Gyrotoma being little known in Europe and of the sparse distribution of examples among the collections. He indicated a suspicion that these shells might be variations or mutations of "certain species of the group of *M. Haysiana,* which live in the same locality." A very just criticism was made of authors who pictured their species in the conventional manner and failed thereby to show the "characteristic notch." Lacking a sufficient number of specimens and illustrations more decisive Brot declined to pass upon the validity of the genus. It is this catalogue I have mentioned later in the text as the Brot list.

In 1869, Dr. James Lewis (4) made a list of the Gyrotomae as part of a catalogue of mollusks of the Coosa River. Tryon's (10) study of the genus appeared in 1873. For half a century it has been a guide for the collector of Pleuroceridae. It erred in the synonymy. The classification was artificial. Too many species were recognized as valid. But when it is remembered that thirteen species of Gyrotoma had been erected from just thirteen specimens and that comparatively few additional shells were available for Tryon's study, that Shuttleworth's species were unknown in this country and Mighels' types had been destroyed by fire, any sharp criticism of Tryon's work with the genus would be unfair.

The next writing upon the subject was by Mr. A. A. Hinkley, whose paper (2) appeared in 1904. He had collected the year before in the

Coosa at Fort William Shoals, Wilsonville and Wetumpka. He distributed a great number of specimens, many of which I have had the opportunity to examine.

Hannibal (2, p. 179) recognized Gyrotoma as a genus and set down Goniobasis as a subgenus. Under the name *Gyrotoma olivula excisa* (Lea) he threw together all the forms that are mentioned in Tryon as being deep-fissured, eighteen species in all. Twenty-two, described as having short or shallow fissures, suffered telescoping under the designation *Gyrotoma laeta incisa* (Lea). Mr. Hannibal was bold, but not without a few misgivings. Preparatory to a prodigious scrambling of the Pleuroceridae he wrote, "It is not anticipated that this treatment will meet with general approval in every instance."

The Alabama Museum collection of Gyrotomae is, of course, unparalleled. It contains thousands of specimens carefully labelled and so painstakingly cleaned that color and sculpture can be made out quickly and with certainty. Notes by Mr. Smith upon his labels and observations he made in his correspondence with Dr. Walker have been invaluable in this study.

THE ENVIRONMENT

The genus is confined to the Coosa River. It has not been found even within the mouths of creeks flowing into the river. The nature of the habitat supplies the explanation. Mr. Smith repeatedly wrote of Gyrotomae as living in rapid heavy currents. Speaking of the genus at Wetumpka he said that it was "almost confined to swift water, and those specimens in pools do not look healthy and are apt to be deformed." A permanent habitat of this kind is rarer among Pleuroceridae than is generally supposed. Io and Anculosa do occupy the swifter parts of rivers, the old as well as the young, but most species of Pleurocera are to be found in quiet water. *Pleurocera unciale* (Hald.), a characteristic east Tennessee species, is in the main part of streams only while partly grown. The adults seek the pools and banks. I have noticed the same thing of *Goniobasis livescens* (Menke) in Ohio, Michigan and Indiana. Colonies of *livescens* are found upon wave-beaten rocks in Lake Erie, but far larger colonies inhabit places much more protected. The ordinary bulbous form of *livescens* lives plentifully in rapids of the upper Wabash River. A depauperate form of the species was collected by Hinkley under stones in the lower part of the river. Such a site, corresponding to that in which Gyrotoma flourishes, was an unhealthy one for a species probably the most adaptive of all Goniobases.

DISTRIBUTION

Gyrotoma first appears in the Coosa at Lock 2, St. Clair County. The only species there and about as far down as the mouth of Yellowleaf Creek of Shelby County is *pyramidatum*. In the short distance between this point and the foot of Peckerwood Shoals, Talladega County, occur five species which are confined to these reaches, namely, *amplum, cariniferum, spillmanii, lewisii* and *hendersoni*. The second and the last of these five are known from Fort William Shoals only. *Alabamensis* is first met with sparingly

on Peckerwood Shoals and disappears below Duncan's Riffle, Chilton County. *Walkerii* has a somewhat shorter range, Weduska Shoals, Shelby County, to Butting Ram Shoals, Coosa County. Five species occur at Wetumpka. Their up-river range from this point is: *Excisum,* to Three-Island Shoals, Talladega County; *laciniatum,* to Fort William Shoals; *incisum* and *pumilum* to Weduska Shoals; *pagoda,* to The Bar, Chilton County.

The localities for Gyrotoma mentioned in this paper are here set down in their order, up-stream to down-stream, the county designations being given as upon Mr. Smith's labels, though the river in most of these places is the border between counties:

Lock 2, St. Clair County.
Ten-Island Shoals, St. Clair County.
Lock 4, St. Clair County.
Riverside, St. Clair County.
Truss Shoals, St. Clair County.
Clarence Shoals, St. Clair County.
Hall's Island, Talladega County.
Yellowleaf Creek (upper), Shelby County.
Three-Island Shoals, Talladega County.
Fort William Shoals, Talladega County.
Peckerwood Shoals, Talladega County.
Weduska Shoals, Shelby County.
Cedar Island, Chilton County.
Adam's Ferry, Chilton County.
Yellowleaf Creek (lower), Chilton County.
Butting Ram Shoals, Coosa County.
Higgin's Ferry, Chilton County.
Wetumpka, Elmore County.

RELATIONSHIPS AND GENERAL CHARACTERS

The affinities of Gyrotoma are with certain Goniobases which should be separated from that genus. These mollusks are characterized by large shells and large opercula. They have the same wide aperture of Gyrotoma and the same microscopic sculpture. The group has not been carefully studied, but these species unquestionably belong to it: *Goniobasis impressa* Lea, *laeta* Jay, *showalterii* Lea (1860), *lewisii* Lea, *bellula* Lea and *ovalis* Lea. Probably others are *gratiosa* Lea and *lachryma* Anthony, which Tryon (10, pp. 342, 343) assigned to Eurycaelon. Occasionally all these species develop incipient fissures. Mr. Smith collected several specimens with fissures nearly as large as in *pyramidatum* and *incisum* and yet, in other regards, retaining their usual Goniobasic features. Every one has a deposit of callus at the top of the columella. This is found in typical Gyrotoma. One specimen of *Goniobasis showalterii,* in addition to having a very small fissure, has a girdle for about 5 mm. upon the body whorl.

After a little study it becomes apparent that Gyrotoma is not a compact genus whose members can be traced with certainty to a common origin. It differentiates into five natural groups. *Pyramidatum* and *spillmanii* form one of these groups. A second consists of *pagoda, pumilum, alabamensis* and *cariniferum.* These two groups would appear to have developed from *Goniobasis laeta* or some other species very like it. *Lewisii* and *hender-*

soni constitute a third group whose relations with *Goniobasis impressa* are quite plain. *Incisum, walkeri* and *amplum,* though not always easily to be distinguished from one another, manifestly differ from the other species of Gyrotoma. The fifth group is made up of *excisum* and *laciniatum*. Their well-fixed characters and their long range in the river justify the belief that they are the oldest species of the genus. I have been unable to find in Goniobasis any species definitely ancestral to the *excisum* and *incisum* groups.

The specific value of some of the races of Gyrotoma, I recognize, is open to question. It requires considerable familiarity with them, and perhaps the habit of mind which goes with studying a family of extreme complexity, to be altogether confident as to the identifications of certain forms, *incisum* and *amplum* for example. Characters overlap. Characters sometimes prominent in one locality fade nearly to invisibility in another. It might possibly be doubted whether variations in the depth of the fissure, being largely a matter of size, warrant recognition beyond subspecific rank.

But difficulties arise in attempting a wholesale lumping of the Gyrotomae. One would have to ignore distinct differences in many of the young and these differences point to ancestral distinctions. The derivation of one group is clearly not the derivation of two other groups. A fourth and a fifth group cannot be traced to any known form. Lumping would consolidate forms independently developed, adding confusion instead of achieving simplicity.

A possibly important question in connection with Gyrotoma is whether it is a genus in course of developing or disappearing. J. C. Willis (11, p. 166) recites three explanations for endemism which he chooses to consider rivals: "(1) That endemics are very specialized species (and genera) suited only to the areas upon which they have been found; (2) that they are old species (and genera) which have been driven into quiet nooks or left in odd corners by the competition of better adapted species; and (3) * * * that in general they are young beginners, descended from the 'wides'." Willis' argument is largely devoted to the advocacy of the third explanation as the one for the majority of cases. I see no reason why all three hypotheses may not apply with almost equal force. The Vitrinizonites of the southern Appalachians may be examples of highly specialized forms narrowly confined to particular localities. An illustration of one form of a relict race is given by Ortmann (7, p. 3-6). *Margaritana margaritifera* (L.) occurs in the headwaters of the Schuylkill River, and in no other place in Pennsylvania. The shells are confined to cold trout streams and in the parts of these that are 800 to 1200 feet above sea level. "The Pennsylvanian area of this species is not only the most southern extension of its range in eastern North America, but it also has the peculiarity of being the only one to the south of the Terminal Moraine. Thus it may be regarded as a part of the Glacial Preserve (refugium) of this species." The great numbers in which Gyrotomae occur in the Coosa River, their variability which is so characteristic of a genus that has not yet become "fixed" and their failure, for all their numbers and apparent vigor, to get beyond a restricted habitat, convince me that they represent "young beginners descended from the 'wides'."

The observations of skilled zoologists with a great deal of field experience have been warnings against giving hastily the emphasis of specific names to the thirteen species herein recognized. Ortmann (6, p. 512) says, "Isolation is, in my opinion, a necessary factor in the differentiation of species and I do not think that a case ever will be discovered where two closely allied species possess precisely the same distribution." Jordan's law (3, p. 547) lays it down that, "Given any species in any region the nearest related species is not likely to be found in the same region nor in a remote region, but in a neighboring district separated from the first by a barrier of some sort." More briefly Ruthven (9, p. 192) declares that "directly related forms on any line of descent occupy neighboring environments."

Several of the closely allied species of Gyrotoma do appear to have exactly the same distribution to all intents and purposes. Unfortunately I have not all the details of Mr. Smith's collecting experiences. But the impression is obtained from his letters and from the notes accompanying the labels that a given reef of a series of shoals is not occupied by a heterogeneous assemblage of mollusks, but by some particular form of the genus, each such colony being cut off from other colonies of the genus by deep water, quiet water, rolling gravel, by mud or by rocks that in dry seasons are exposed to the air. Thus within a small area, too small to be especially observed by the collector not upon the lookout for it, there may be a distinct differentiation of locality, small barriers with as powerful an influence upon Gyrotomae as barriers quite plain to the eye—all the effects of isolation.

THE OPERCULA

The opercula of all Gyrotomae are large, leathery, dark red to dark brown. The growth lines are crowded. The surface in instances is more or less marked with microscopic wrinkles which tend to form irregular lines or bands at right angles to the growth lines. The nucleus is indented. Opercula wear down quickly and become irregular in shape so that in the cases of adults the shape is frequently quite different from that in the young. In old specimens the nucleus or area of the inner whorls is often completely eroded away.

In this study the opercula were first examined in connection with the shells. Later they were more carefully re-examined and compared with one another, species by species. There are recognizable differences, but I cannot feel that they are of great importance. The opercula of *pyramidatum, spillmanii, lewisii* and *hendersoni* are quite broad and with the inner whorls well within the operculum. *Pagoda* has a narrower, darker operculum, the apex more blunt. In *pumilum, alabamensis* and *cariniferum* the opercula are mostly of the *pagoda* form, but have become slightly broader and noticeably larger. The opercula of *excisum* and *laciniatum* are practically identical, being smaller than in *pyramidatum*, darker, thinner and broader than in *pagoda*. The inner whorls are tightly coiled rather than loosely. The operculum of *incisum* are thin, ragged, variable in shape. In *walkeri* and *amplum* the opercula are much the same as those of *incisum*, but in *amplum*

they appear to run decidedly larger and this is not to be explained by the size of the aperture. The nucleus of all except *pyramidatum* is quite close to the left margin and near the base.

A few opercula have been illustrated, but without any intention of accenting differences. Many of the differences are possibly due to variations in the erosion to which this feature is subjected in strong currents. The opercula of quite young Gyrotomae are very nearly uniform.

GENUS GYROTOMA SHUTTLEWORTH

Schizostoma Lea, (non Bronn, 1835), Proc. Amer. Phil. Soc., II, 1843, p. 242; Trans. Amer. Phil. Soc., IX, 1844, p. 26; X, 1848, pp. 67, 93; I, n. s., 1852, p. 295; Proc. Acad. Nat. Sci., Phila., XII, 1860, p. 186; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, pp. 218, 243, 245, 246; VI, 1866, p. 152; Obs. Gen. Unio, IV, 1848, pp. 26, 67, 93; V, 1852, p. 51; IX, 1863, pp. 40, 65, 67, 68; XI, 1867, p. 108; Tryon, Amer. Journ. Conchol., I, 1865, pp. 114-116, 131; II, 1866, p. 134; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, pp. xxiii-xxvii, xxxiii, xxxv, xxxix, xlvi, 351; Hinkley, Nautilus, XVIII, 1904, p. 40, 41.

Gyrotoma Shuttleworth, Mittheil. der Nat.-forsch. Gesellsch. in Bern., July 22, 1845, p. 88; H. & A. Adams, Genera, I, 1854, p. 305; Gray, Guide to Mollusca, I, 1857, p. 103; Chenu, Man. de Conchyl., I, 1859, p. 293; Anthony, Proc. Acad. Nat. Sci., Phila., XII, 1860, p. 53; Binney, Check List, 1860; Brot, List, 1862, p. 27; Tryon, Monog. Strepom., 1873, pp. xv, xviii, xxiii, xxiv-xxvii; Paetel, Cat., 1888, p. 361; Pilsbry, Proc. Acad. Nat. Sci., Phila., 1896, p. 497; Hannibal, Proc. Malacol. Soc., X, 1912, p. 179.

Schizochilus Lea, (non Gray, 1850), Trans. Amer. Phil. Soc., X, n. s., 1852, p. 295; Obs. Gen. Unio, V, 1852, p. 51; IX, 1863, p. 67; Proc. Acad. Nat. Sci., Phila., XII, 1860, p. 186; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 245; Tryon, Monog. Strepom., 1873, pp. xxiv, xxxiii.

Melatoma Anthony, Gray, Proc. Zool. Soc. of London, 1847, p. 153; Woodward, Manual, 1851, p. 131; Reeve, Conch. Icon., 1860.

Apella Mighels, MS., 1860.

"Shell turreted; columella incurved, thickened above by an intermarginal callus; aperture oval, somewhat spread out (effuse) at the base; lip simple, sharp, with a narrow fissure, deeply notched.

"Animal. ————; operculum corneous, spiral."—Shuttleworth.

GROUP OF *Gyrotoma pyramidatum*

Rather heavy, pyramidal especially in the young, sometimes nodose, smooth to striate; fissure shallow, oblique, not exceeding 8 mm. in depth; girdle not always conspicuous; aperture ovate; sinus not pronounced; bands usually four and of equal width.

Gyrotoma pyramidatum Shuttleworth

Pl. I, figs. 1, 2, and 3

Gyrotoma pyramidata Shuttleworth, Mittheilungen der Naturforschenden Gesellschaft in Bern, No. 50, July 22, 1845, p. 88; H. & A. Adams, Genera, I, 1858, p. 305; Binney, Check List, 1860, No. 329; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 361.

Gyrotoma conica Shutt. (?), Troschel, Gebiss der Schnecken, I, 1857, p. 111, pl. 8, fig. 12; Brot, List, 1862, p. 27; Tryon, Monog. Strepom., 1873, p. 380.

Gyrotoma lacta incisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 182.

Schizostoma pyramidatum Shutt., Tryon, Monog. Strepom., 1873, pp. xv, 365; Lewis, Fauna of Ala., 1876, p. 23.

Description: Shell pyramidal, heavy, olivaceous or blackish, concentrically sulcate-costate, more often with rough knobs (nodules); banded with brown, apex eroded; whorls 5 or 6; fissure short, broad, columella thickened tuberculously above.

Length, .9; breadth of the ultimate whorl, .412-.5 of an inch. Length of aperture, .312; length of fissure, .1 of an inch.

Obs.—Somewhat resembles *Melania canaliculata;* varies as the preceding (*G. ovoidea*).

A few specimens . . . occur among others, with the upper whorls acutely carinated, ridges and furrows fewer and almost obliterated; epidermis paler and apex little eroded.—Shuttleworth.

This is the first Gyrotoma appearing in the river. Mr. Smith's highest station for it was Lock 2, which is at the head of Ten-Island Shoals, between St. Clair and Etowah counties. Shuttleworth in his preface states that Rugel collected in the Coosa River, near Wetumpka. But there is sound reason for believing that this is an error. The species was never taken by persons who collected from Wetumpka as far up the stream as Fort William Shoals. The nodulous character of the shells sent to Europe is a peculiarity almost entirely confined to Pleuroceridae upon and near Ten-Island Shoals. Not only are the Gyrotomae of this locality so marked and the so-called Eurycaelon, but also Anculosae and Goniobases. In a letter to Dr. Walker, Mr. Smith said that even certain Pleurocerae are likewise affected. The oddity is not in mollusks collected farther up the river. It tends to disappear below these shallows.

The fissure[1] is shallow, oblique, and is angled rather than curved or sinuous as in *incisum,* also having a short fissure. At Lock 2, the fissure has a maximum depth of 3 1-2 mm. At Hall's Island, it is as deep as 5 mm. and is not so oblique as in material from the higher locality. Obliqueness is more pronounced in young specimens than in old; in juveniles the fissure is a mere notch. The hem is only faintly marked, being of much the same color as the rest of the shell; it is to be observed in hardly more than half the shells.

The pyramidal aspect is that mostly of individuals one-half to three-fourths grown. The base is usually rounded in adults. Knobs, when present, give the shell a squared, four or five-sided appearance, and are not spaced regularly. Color[2] ranges from honey-yellow to raw-umber. The prevailing banding formula is four bands of equal width. The aperture is ovate. The white or bluish-white columella is smoothly rounded, slightly

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[1]In the literature of Pleurotomariidae the fissure is spoken of as the "anal sinus" and the girdle or hem as the "sinus band". I have preferred to use the terms of the early writers upon Gyrotoma even if the others be more descriptive. Doubtless as in the marine mollusk the fissure of Gyrotoma serves a purpose for the discharge of excreta.

[2]The colors assigned in this study are according to "Color Standards and Color Nomenclature" of Ridgway, 1912. While a fairly large number of names have been given in order to be as exact as possible it will be remarked that the color range in this genus is rather limited.

produced at the base and has a node at the fissure. It attains full development earlier in this species than in any other of the genus. The outer lip is sinuous. The largest *pyramidatum* measured, which probably would have eight whorls if uneroded, is 21 x 11 1-2 mm.

A young specimen from Lock 2, having five whorls, is conic, carinated at the periphery of the whorls, sharply angulate of base. The whorls are flat and without folds. The columella is undeveloped. There is scarcely more than an indication of fissure. Bands are three in number.

Mr. Smith's lowest locality for *pyramidatum* is Hall's Island, Talladega County. There are two specimens in the Schowalter Collection which I judge to be this species. The locality is mouth of Yellowleaf Creek (Shelby County). This is a few miles below Hall's Island.

Dr. Walker compared specimens taken by Mr. Smith with types of *pyramidatum* and *conica* in Geneva and found them to be the same. *Conica* does not appear to have been formally described. Dr. Walker, who came upon material in the Geneva Museum so labeled, suggests that the remarks at the end of the description of *pyramidatum* might have been intended to refer to this form.

Gyrotoma spillmanii (Lea)

Pl. I, figs. 4 and 5

Schizostoma Spillmanii Lea, Proc. Acad. Nat. Sci., Phila., XIII, 1861, p. 54; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 250, pl. 35, fig. 55; Obs. Gen. Unio, IX, p. 72, pl. 35, fig. 55.

Schizostoma babylonicum Lea, Tryon, Monog. Strepom., 1873, p. 369.

Gyrotoma Spillmanii Lea, Paetel, Cat., 1888, p. 362.

Gyrotoma laeta incisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 182.

Schizostoma Wheatleyi Lea, Proc. Acad. Nat. Sci., Phila., XX, 1868, p. 153; Journ. Acad. Nat. Sci., Phila., VI, 1868, p. 342, pl. 54, fig. 27; Obs. Gen. Unio, XII, 1868, p. 342, pl. 54, fig. 27; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 169; Lewis, Fauna of Ala., 1876, p. 23.

Description: Shell striate, subcylindrical, rather thick, yellowish-brown, imperforate; spire obtuse, conoidal; sutures impressed; whorls six, very much banded, flattened, the last large; fissure oblique and rather short; aperture large, ovate and banded within, obtusely angular at the base; columella white, thickened above; outer lip sharp and sinuous.

Operculum ovate, spiral, rather large, dark brown with the polar point near to the left edge, about one-fifth above the basal margin.

Habitat: Coosa River, Alabama; Dr. F. R. Showalter.

Diameter, .48; length, .92 of an inch.—Lea.

The fissure of *spillmanii* is like that of *pyramidatum* from Hall's Island. The young, though larger, whorl for whorl, are hardly to be separated from juvenile *pyramidatum*. The types carry the resemblance because they have unusually shallow fissures for adult *spillmanii*. But this species in general is a larger, coarser race, more boldly sculptured, pyramidal only in the adolescent stage and so stepped at the suture as to suggest to Tryon that it was the same as *babylonicum* Lea. I think it can stand as a species, related closely to *pyramidatum* or springing at no great distance in time from the same ancestral form.

The fissure is 3 to 8 mm. in depth, always oblique. Of 20 specimens in one lot, 11 have a wide fissure, in 9 it is narrow. Most of these latter individuals show signs of injury or deformation at the top of the whorl. The girdle is cord-like, irregular, more or less conspicuous by reason of differing in color from the body of the shell.

Spillmanii is heavy, nodulous, though sometimes smooth, frequently constricted, slightly plicate upon the early whorls. Fourteen shells in the lot of 20 have stout, revolving folds, 5 have folds nearly obsolete and 1 is smooth. Growth lines are fine to coarse, the scars of rest periods being quite prominent. An adult with three remaining whorls measures 25 x 13 1-2 mm. Color varies from sulphine-yellow to buffy-citrine. Bands are four, all of the same width. This is the prevailing formula. Variations are modifications of this formula. The aperture is wide, ovate, the sinus at the base scarcely noticeable. The columella is white, thick, broadly rounded and has a heavy callous at the top. The outer lip is slightly sinuous.

A young shell of five whorls is pyramidal, obscurely plicate, subangulate at the base. The columella is small, undeveloped; the fissure a mere curving indentation. A full grown shell would have eight whorls probably if uneroded.

The more nearly typical shells examined in the Alabama collections were taken by Dr. Schowalter and the locality given is "Coosa River, Shelby County, Ala." A smooth form, less robust and with a shallow fissure corresponding with the types, was taken by Mr. Smith in Peckerwood Shoals. No other localities are known.

The type of *wheatleyi,* save in point of size, looks very much like *spillmanii* in form, sculpture, bands and fissure. This seems to be the only shell of the kind that was collected by Schowalter. Mr. Smith found two small shells which I feel convinced are dwarfed *spillmanii,* but curiously they differ greatly from Lea's *wheatleyi.*

In his formal description, Lea mentions Dr. Schowalter as the collector from whom he received *spillmanii.* Later, under "observations," he says, "I have a number of specimens, chiefly young, from Dr. Spillman and a fine suite of different ages from Dr. Schowalter." All these shells are in the United States National Museum. Certain ones, with a label (1) pasted upon them, I have ventured to assume to be the types. They correspond to the Schowalter shells in the Alabama Museum collection. With them are two specimens of *G. pagoda* Lea and a third Gyrotoma broken and indeterminate. These probably are the sendings from Dr. Spillman. Three other lots under the name of *Spillmanii* agree with the Schowalter mollusks and a fifth consists again of *pagoda.*

GROUP OF *Gyrotoma pagoda*

Conical to globose, smooth to striate, the young carinate and more or less obscurely plicate; fissure oblique to straight, not exceeding 10 mm. in depth; girdle of varying size and color; aperture more frequently elliptical than ovate; sinus usually distinct; bands, ordinarily four and equidistant.

Gyrotoma pagoda (Lea)

Pl. I, figs. 6, 7, 8, and 9

Schizostoma pagoda Lea, Proc. Amer. Phil. Soc., IV, 1845, p. 167; Trans. Amer. Phil. Soc., X, 1848, p. 93, pl. ix, fig. 52; Obs. Gen. Unio, IV, 1848, p. 93, pl. ix, fig. 52; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 247; Obs. Gen. Unio, IX, 1863, p. 69; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 169; Tryon, Monog. Strepom., 1873, pp. xv, 365; Lewis, Fauna of Ala., 1876, p. 23.

Gyrotoma pagoda Lea, Chenu, Manuel, I, 1859, fig. 2,020; H. & A. Adams, Genera, I, 1858, p. 305; Binney, Check List, 1860, No. 327; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Melatoma pagoda Lea, Reeve, Monog. Melatoma, 1860, sp. 1.

Schizostoma Wetumpkaensis Lea, Proc. Acad. Nat. Sci., Phila., 1860, p. 187; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 251, pl. 35, fig. 56; Obs. Gen. Unio, IX, 1863, p. 73, pl. xxxv, fig. 56; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 169; Tryon, Monog. Strepom., 1873, p. 366; Lewis, Fauna of Ala., 1876, p. 23.

Melatoma Wetumpkaense Lea, Reeve, Monog. Melatoma, 1861, sp. 17.

Melatoma ornata Anth., MSS., Reeve, Monog. Melatoma, 1861, sp. 11.

Gyrotoma ornata Anth., Paetel, Cat., 1888, p. 362.

Melatoma Anthonyi Reeve, Monog. Melatoma, 1861, sp. 12.

Gyrotoma Anthonyi Reeve, Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 361.

Schizostoma Anthonyi Reeve, Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, p. 368; Lewis, Fauna of Ala., 1876, p. 22.

Melatoma funiculatum Lea, Reeve, Monog. Melatoma, 1860, sp. 5.

Schizostoma pyramidatum Shutt., Hinkley, Nautilus, XVIII, 1904, p. 41.

Gyrotoma lacta incisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 182.

Description: Shell carinate, conical, rather thick, dark horn-color; spire rather short; sutures very much impressed; whorls six; fissure small; aperture elliptical, within whitish; columella smooth.

Habitat: Tuscaloosa, Alabama.

Diameter, .35; length, .75 of an inch.—Lea.

The pagoda-like form of this species is especially striking in the juvenile specimens and to such an extent, indeed, that these shells resemble *Goniobasis catenaria* Say. The carinae are very wide and turned upward at the edges. The suture is deeply channelled, the fissure a mere indentation. Embryo shells are about 1 1-4 to 2 whorls in size, unsculptured. The first two carinated whorls are scalloped by strong and regularly spaced plicae. As the animal grows larger, the carinae tend to disappear so that in many instances the shell is ventricose and smooth. The Wetumpka form is characterized by revolving folds, these disappearing in up-river specimens. Microscopical sculpture typically gyrotomoid.

Color varies from Ridgway's "old gold" to warm sepia. The proportion of banded to unbanded shells is about five to four. The prevailing banding system is four equidistant bands of the same width. The columella is rather narrow, rounded, with a slight nodulous thickening above. The outer lip is sharp-edged, slightly sinuous. A Wetumpka specimen measured 20 x 12 1-2 mm., the largest from up-river shoals, 22 1-2 x 14 mm.

The fissure is short, straight and bluntly rounded at the opening in old shells. It is seldom more than 3 mm. in depth. Compared with the fissure in *pumilum* that of *pagoda* is shorter and more flaring; apparently it is always straight.

The known range for the species is from The Bar, Chilton County, to Wetumpka, Elmore County.

Lea speaks of *wetumpkaensis* as umbilicate. This is merely an effect of erosion. Sometimes the animal leaves a chink close to the border of the columella and the opening is widened irregularly by corrosion. Three lots of *wetumpkaensis* in the Lea collection agree very well with *pagoda,* though less carinated and having color bands. *Ornata* is a young shell. The locality given, North Carolina, is apparently, as Tryon points out, a confusion with *Anculosa ornata* Anth. from that state. Dr. Walker examined the type of *anthonyi* in the British Museum and found it to be identical with *pagoda.* Lewis (5, p. 23) suggested the possibility of *wetumpkaensis* being a variety or the young of *pagoda.*

Gyrotoma pumilum (Lea)

Pl. I, figs. 10 and 11

Schizostoma pumila Lea, Proc. Acad. Nat. Sci., Phila., XII, 1860, p. 187; Journ. Acad. Nat. Sci., V, n. s., 1862, p. 252, pl. 35, fig. 57; Obs. Gen. Unio, IX, 1863, p. 74, pl. xxxv, fig. 57; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 169; Tryon, Monog. Strepom., 1873, p. 357; Lewis, Fauna of Ala., 1876, p. 23.

Gyrotoma pumila Lea, Binney, Check List, 1860, No. 328; Brot, List, 1862, p. 27.

Gyrotoma olivula excisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 182.

Melatoma Alabamense Lea, Reeve, Monog. Melatoma, 1861, sp. 20.

Schizostoma globosa Lea, Proc. Acad. Nat. Sci., Phila., XII, 1860, p. 186; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 252, pl. 35, fig. 58; Obs. Gen. Unio, IX, 1863, p. 74, pl. xxxv, fig. 58; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168.

Schizostoma excisum Lea, Hinckley, Nautilus, XVIII, 1904, p. 41.

Gyrotoma globosa Lea, Binney, Check List, 1860, No. 321; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Melatoma globosum Lea, Reeve, Monog. Melatoma, 1861, sp. 18.

Description: Shell striate, top-shaped; rather thin, pale horn-color, imperforate; spire very obtuse; sutures much impressed; whorls six, ventricose, the last very large; fissure straight and rather short; aperture rather small, ovate, white within, angular at the base and somewhat canaliculate; columella white, twisted and thickened below; outer lip acute and sinuous.

Habitat: Alabama; B. W. Budd, M. D.

Diameter, .40; length, .63 of an inch.—Lea.

The fissure of *pumilum* is "rather short" only as compared with the character in such species as *excisum.* It may be considered as moderately deep for the genus. It is narrow, usually straight, rarely slightly oblique. In Wetumpka specimens examined, this slit has a maximum depth of 7 1-2 mm., in a specimen from Higgin's Ferry, it is 9 1-4 mm. deep. The girdle is more marked in some specimens than in others, varying also in color and size. Cross sections showed the girdle to be hollow for about 3 or 4 mm. behind the fissure. Behind this hollow space it was filled with fine crystalline shell material.

The adult is ovate, with whorls slightly convex, the base rounded; often very heavy. The spire in partly grown shells is obtuse, with faint plicae, often missing. The largest Wetumpka specimen measures 18¼ x 11½ mm., the largest up-river shell, 22 x 12 mm. Ten or twelve revolving folds appear on the body whorl in Wetumpka lots, tending to disappear in colonies

farther up the Coosa. For example, at Butting Ram Shoals, half the *pumilum* are smooth. Color varies from sulphine-yellow to dark olive. About one shell in four lacks color bands. The prevailing formula is four bands, the third from the top being smaller than the others. The aperture is ovate to elliptical, white to yellowish-white. In Wetumpka shells the folds show through as broad white bands in the aperture. The columella is rounded, not wide, white to bluish-white. It is not nearly as stout as might be expected in a shell of this size. At the mouth of the fissure is a spot of white callus. The outer lip is curved outward at the top and is slightly crenulate in shells with folds.

In juveniles the spire is smooth, conic, the whorls flat, the suture not much impressed, the periphery angular. The fissure begins with the fifth whorl. Embryo shells are of about 1½ whorls, closely coiled and without sculpture.

The species occurs from Weduska Shoals to Wetumpka. The Weduska Shoals specimens are a dwarf form, occurring in very small numbers. The largest is 19 x 9 mm. The shell is delicate, shining, the upper whorls having low plicae, the base bearing obscure folds. The fissure in these specimens is straight to slightly oblique, 3 to 4 mm. in depth. The temptation has been to allow them a distinctive name, but the form appears to correspond with dwarf *pumilum* collected by Mr. Smith at Higgin's Ferry, The Bar and Duncan's Riffle.

A note upon one of Mr. Smith's labels for this species reads, "On rocks, in very swift water, 1-3 feet deep."

Hinkley (2, p. 41) makes *pumilum* a synonym of *excisum*. An examination of the types of the two species compels me to disagree with him.

Gyrotoma alabamensis (Lea)

Pl. I, figs. 12 and 13

Schizostoma Alabamensis Lea, Proc. Acad. Nat. Sci., Phila., XII, 1860, p. 187; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 250, pl. 35, fig. 54; Obs. Gen. Union, IX, 1863, p. 72, pl. xxxv, fig. 54; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, p. 367; Lewis, Fauna of Ala., 1876, p. 22.

Gyrotoma Alabamensis Lea, Binney, Check List, 1860, No. 305; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 361.

Gyrotoma olivula excisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 181.

Melatoma babylonicum Lea, Reeve, Monog. Melatoma, 1860, sp. 6.

Description: Shell striate, elliptical, stout, yellowish-olive, imperforate; spire obtusely conical; sutures very much impressed; whorls six, banded, rather inflated, the last very large; fissure oblique and rather short; aperture rather large, ovate, banded within and obtusely angular at the base; columella white, somewhat thickened above and below; outer lip sharp and sinuate.

Habitat: Alabama; B. W. Budd, M.D., and Dr. E. R. Showalter.

Diameter, .50; length, .90 of an inch.—Lea.

The description, "fissure oblique and rather short" so misled Mr. Smith that when he found *alabamensis* he was compelled to believe that he had come upon a new species. Examination of the type disclosed, however, that the shells of Lea and Smith were the same. The fissure varies from straight to oblique. Of 37 shells from The Bar, Chilton County, 16 had

straight fissures. The difference did not seem to be a matter of age. The depth of fissure is from 6 mm. in half-grown shells to 10 mm. in old. The girdle is yellow, rather wide, and is well-marked in nearly all specimens.

The species is probably the most robust of the genus. The largest specimen in the Alabama collection measures 26½ x 13½ mm. The base is sub-angular up to three-fourths of the growth. In adults, it is rounded. The folds are low, not always regularly-spaced, and are stoutest in young shells. Occasional smooth shells have been taken. A distinct tendency toward plication is noticeable upon the upper whorls. The nearly miscroscopic sculpture consists of fine growth lines, crossed by discontinuous, wavy transverse lines. The color is buckthorn-brown to deep olive. Two bands of equal width, at top and base respectively, and a third band, much wider, at the periphery constitute the commonest banding formula. In many specimens coloring matter is deposited in the base of the folds and this shows in the aperture as bands or lines. The aperture is elliptical rather than ovate. The columella is white, not very wide, thinning above the center into a bluish-white wash with a porcelainous node at the mouth of the fissure. The sinus is distinct. The outer lip is sharp-edged, crenulate, slightly sinuous.

Young shells are ovate, sub-angulated, plicate upon the post-embryo whorls; the fissure straight, not wide; the columella narrow, yellowish-white; the sinus having a shallow channel. Seven or eight whorls are indicated for the adult specimen.

The range of *alabamensis* is from Peckerwood Shoals, Talladega County, to Duncan's Riffle, Chilton County.

Peckerwood Shoals shells are wider in proportion to height than specimens from other known localities and they show, more than these others, the relationship of *alabamensis* and *cariniferum* Anth. A varietal name does not seem to be warranted in the case of this race unless other varieties, and there are several, are also so baptized. In nearly all the lots are shells close to *pumilum* in general appearance. *Pagoda* may be considered a third or fourth cousin to the southward and *cariniferum* a first or second cousin to the north.

Gyrotoma cariniferum Anthony

Pl. I, figs. 14 and 15

Gyrotoma carinifera Anth., Proc. Acad. Nat. Sci., Phila., XII, Feb. 1860, p. 66; Binney, Check List, 1860, No. 310; Brot, List, 1862, p. 27; Pactel, Cat., 1888, p. 361.

Melatoma cariniferum Anth., Reeve, Monog. Melatoma, 1861, sp. 13.

Schizostoma cariniferum Anth., Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, p. 353; Lewis, Fauna of Ala., 1876, p. 22.

Schizochilus Showalterii Lea, Proc. Acad. Nat. Sci., Phila., XII, March, 1860, p. 93.

Schizostoma Showalterii Lea, Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 246, pl. 35, fig. 49; Obs. Gen. Unio, IX, 1863, p. 68, pl. xxxv, fig. 49.

Gyrotoma Showalterii Lea, Binney, Check List, 1860, No. 334; Brot, List, 1862, p. 28.

Gyrotoma olivula excisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 181.

Description: Shell conic, thick, dark brown; spire obtusely elevated, truncate, though not abruptly so, six whorls remaining, one or two having apparently been lost by truncation; carinations elevated, subacute and found on all the whorls, two on each of the spiral ones and three or four on the body whorl; fissure direct, broad and moderately deep, extending about one-fifth around the shell; sutures irregular, much modified by the carinae, and often concealed in part by them; aperture ovate and banded within; columella much rounded, callous at the lower part only; outer lip irregularly waved, its outline modified by the carinae on the body-whorl; no sinus.

Habitat: Coosa River, Alabama.

Length of shell, 7-8; breadth of shell, 1-2 of an inch. Length of aperture, 5½-16 of an inch; breadth of aperture, 1-4 of an inch.—Lea.

The opportunity has been given to examine the type of *cariniferum,* which is in the Museum of Comparative Zoology. The shell is about three-fourths grown. The fissure is rather narrow as compared with the same character in several other species, is slanting and 8½ mm. deep. In twenty-five other specimens the fissure of seven is straight, very slightly oblique in one and noticeably oblique in seventeen. The girdle is narrow and of much the same color as the body of the shell.

Full grown specimens are not so stoutly ribbed as younger ones, and in instances the folds become almost obsolete. A few greatly resemble *G. alabamensis* Lea. The largest shell measured 24 x 15 mm. It should be said that in the cut published by Tryon (10, p. 353) the ribs are made to seem more twisted than they actually are in the type. The color is brownish olive. The banding formula, common to the group, is four bands, the third from the top being smaller than the rest. Variations occur, but they are modifications of this formula. The aperture is more often elliptical than ovate. In old specimens the columella is white, wide, continuous and with the usual node of porcelain-like callus at the top. Young shells are angulated at the base. They indicate that an uneroded adult would have eight whorls.

The only locality known for this species is Fort William Shoals. In 1914, shortly after a visit to this site, Mr. Smith wrote to Dr. Walker, "On a reef * * * I struck *G. cariniferum;* the only ones I had seen before were a broken specimen in the Schowalter collection and about ten I had collected last year in a lower part of Fort William Shoals. In this new place we gathered about 200 in three hours, and I think we scraped the place nearly clean. The species occurred only in about fifteen yards of the reef and always in the swiftest water where other Gyrotoma cannot stick. There was one little pool under a fall which must have yielded over 100 fine ones."

Hinkley (2, p. 41) mentions *showalterii* Lea. It is not clear that he refers to the species which has had to give way to *cariniferum* by reason of the rule of priority or to the one given the same name by Lea in 1864.

GROUP OF *Gyrotoma lewisii*

Elongate to ventricose, the whorls almost flat, sometimes ligulate, the shell rather heavy and resembling *Goniobasis impressa* Lea in sculpture; fissure oblique, with a maximum depth of 6 mm.; girdle not pronounced; aperture narrow; the sinus distinct; bands consisting usually of many fine lines.

Gyrotoma lewisii (Lea)

Pl. I, figs. 16, 17, and 18

Schizostoma Lewisii Lea, Proc. Acad. Nat. Sci., Phila., XXI, 1869, p. 62; Journ. Acad. Nat. Sci., Phila., VIII, 1874, p. 61, pl. 21, fig. 16; Obs. Gen. Unio, XIII, 1874, p. 65, pl. xxi, fig. 16; Lewis, Amer. Journ, Conchol., V, 1869-70, p. 168; Lewis, Fauna of Ala., 1876, p. 23; Hinkley, Nautilus, XVIII, 1904, p. 41.

Description: Shell closely striate, subcylindrical, rather thin, yellowish-brown, imperforate; spire conical, folded; sutures very much impressed; whorls about seven, the last one large; fissure oblique and short; aperture large, rhomboidal, banded within; outer lip crenulate and sinuous; columella white, thickened and twisted.

Habitat: Coosa River, Alabama, Dr. E. R. Schowalter.

Diameter, .5; length, .9 inch.—Lea.

The fissure is oblique, shallow, 2¾ to 3¾ mm. in depth. There is no distinct girdle. A broadening or shouldering of the whorl immediately below the suture appears to serve the purpose of covering the fissure as growth proceeds. In young shells this shoulder does not occur though the mollusk has a well-developed fissure at this stage.

Lewisii is stout, ventricose to elongate and is covered with fine, sharply cut folds or riblets, closely set and varying slightly in size. Growth lines are fine, being crossed by minute discontinuous revolving lines not always distinct beneath a hand lens. A few specimens are constricted upon the body whorl though none taken by Mr. Smith is so much constricted as in the figure of Lea's type. Color usually citrine. All the ribs seem to contain more or less coloring matter. In young shells this shows through into the aperture, giving an effect of numerous bands. As shell material is deposited the finer bands or lines tend to disappear. The usually narrow and elliptical aperture has a distinct sinus at its base. The columella is broad and, in immature specimens, merely a wash of white above the center of the aperture. The node at the top is not prominent. One specimen has a reddish columella. The largest shell is 22½ x 12½ mm.

Half-grown specimens are conic, subangulate, slightly carinate and have a pronounced sinus. The fissure is very shallow, but well-marked.

Mr. Smith's shells, and presumably those taken by Dr. Schowalter, were collected on Fort William Shoals. Hinkley (2, p. 41) gives Wilsonville as another locality. This would seem to be on or within touch of Three-Island Shoals.

Dr. Lea remarked upon the resemblance of his species to *Goniobasis impressa* Lea. Save in regard to the fissure of *lewisii*, the two shells are exceedingly alike. The one, I believe, can be considered an offshoot of the other.

Gyrotoma hendersoni H. H. Smith, new species

Pl. II, figs. 19, 20, and 21

Shell: Subcylindrical, rather heavy, whorls almost flat, the last broadly rounded at the base. Apex eroded, only two whorls remaining. The entire shell is covered with low folds of varying size which tend to wave or break where new shell material has been deposited after rest periods. Between the folds of the penultimate whorl the fine

vertical growth lines are crossed by transverse lines, very delicate and usually discontinuous. Fissure oblique, 6 mm. in depth. The suture is covered by a narrow, cord-like, irregular girdle somewhat lighter than the general body color. In a broken place in this "hem" the suture appears as deeply impressed or channelled. Color of shell brownish-olive. The bands are deposits of coloring matter in the base of the folds, sometimes coalescing so that for the eleven folds of the body whorl six bands show in the aperture. Columella narrow, rounded from center to base, flattened above the center and having a heavy callus at the fissure; white from center to base, dull purple above. Aperture elliptical, with a distinct sinus below. Outer lip a little crenulate, firm, broadly curving outward at the top and slightly inward at the base.

Operculum: Leaf-like, leathery, very dark red. Apex acute, base rounded; right margin much more curved than the left. Whorls three, the first two tightly coiled and close to the left margin and about 1 mm. from the base. The region of the inner whorls is excavated or crater-like. Radiating lines are of varying strength. Altitude 8 1-2 mm.; diameter 4 1-2 mm.

Measurements: Altitude, 21 mm.; diameter, 12 mm. Aperture: Lowest part of fissure to base, 10 1-2 mm.; diameter, 4 1-4 mm.

Type Locality: Coosa River, Fort William Shoals, Talladega County, Ala.

Type in Museum of Zoology, University of Michigan; paratypes in Alabama Museum of Natural History.

The affinities of this species are with *G. lewisii* (Lea). It differs in having fewer and stouter folds, a more rounded body whorl, a deeper and less oblique fissure and less shouldered aspect. While the question may rise as to whether *lewisii* is *Goniobasis impressa* Lea with a gyrotomoid outer lip the position of *hendersoni* as a true Gyrotoma is not to be questioned.

The fissure varies from 3½mm. in depth in young shells to 6 mm. in adults. As depth increases, the fissure becomes less oblique, or to put it another way, more narrow. There is little variation in form, sculpture and color. The bands are from five to ten, following no formula as in most other species of the genus. A young specimen of *hendersoni* is thin, subangulate. The fissure is shallow, the suture rather indistinct, the bands many and linear. Eight whorls are indicated for a full-grown specimen.

The only locality known for this species is Fort William Shoals. Writing from this place on July 17, 1914, Mr. Smith said: "On a reef just above we got the regularly striate form which I have been callng *G. lewisii,* though I am not at all sure. With it another which I take to be *G. babylonicum,* and a third form undescribed which I propose to name *G. hendersoni;* it is striate much like *lewisii,* but has a square and moderately deep slit." In September of the same year, Mr. Smith wrote: "The species which I propose to name *hendersoni* is one of the most beautiful of the genus and is apparently very constant."

GROUP OF *Gyrotoma excisum*

Quadrate, bulbous, conic or elongate; the whorls smooth or with folds, often faintly plicate; fissure ordinarily straight and as deep as 10 mm.; girdle well-marked, though sometimes absent; aperture elliptical; sinus distinct; bands: three in *excisum,* four in *lacinatum.*

Gyrotoma excisum (Lea)

Pl. II, figs. 22 and 23

Melania excisa Lea, Proc Amer. Phil. Soc., II, 1843, p. 242; Trans. Amer. Phil. Soc., IX, 1844, pp. 25, 29; Trans. Amer. Phil. Soc., X, 1848, p. 93; Obs. Gen. Unio, IV, 1848, pp. 25, 29, 93; Jay, Cat., 4th ed., 1852, p. 273.

Schizostoma excisa Lea, Wheatley, Cat. Shells U. S., 1845, p. 28; Lea, Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 250; Obs. Gen. Unio, IX, 1863, p. 72; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, pp. xv, xxiii, xxv, 356; Lewis, Fauna of Ala., 1876, p. 23.

Gyrotoma excisa Lea, H. & A. Adams, Genera, I, 1858, p. 305; Binney, Check List, 1860, No. 317; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Gyrotoma olivula excisa (Lea), Hannibal, Proc. Malacol, Soc., X, 1912, p. 181.

Melatoma excisum Lea, Reeve, Monog. Melatoma, 1860, sp. 2.

Melatoma Showalterii Lea (prob. *excisum*), Reeve, Monog. Melatoma, 1861, sp. 23.

Gyrotoma ovoideum Shutt., Mittheil, Bern. Nat. Gesell., No. 50, July 22, 1845, p. 88; H. & A. Adams, Genera, I, 1858, p. 305, pl. 32, fig. 4; Paetel, Cat., 1888, p. 362.

Schizostoma ovoideum Shutt., Tryon, Monog. Strepom., 1873, pp. xv, 356; Lewis, Fauna of Ala., 1876, p. 23; Hinkley, Nautilus, XVIII, 1904, p. 41.

Gyrotoma bulbose Anth., Proc. Acad. Nat. Sci., Phila., Feb. 1860, p. 65; Binney, Check List, 1860, No. 309; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 361.

Melatoma bulbosum Anth., Reeve, Monog. Melatoma, 1861, sp. 22.

Schizostoma bulbosum Anth., Lewis, Amer. Jour. Conchol., 1869-70, p. 168; Tryon, Monog. Strepom., 1873, p. 361; Lewis, Fauna of Ala., 1876, p. 22.

Gyrotoma ovalis Anth., Proc. Acad. Nat. Sci., Phila., Feb., 1860, p. 65; Binney, Check List, 1860, No. 325; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Schizostoma glans Lea, Proc. Acad. Nat Sci., Phila., 1860, p. 186; Journ, Acad. Nat. Sci., Phila., V, n. s., 1862, p. 248, pl. 35, fig. 52; Obs. Gen. Unio, IX, 1863, pp. 70, 71, 74, pl. xxxv, fig. 52; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, p. 363; Lewis, Fauna of Ala., 1876, p. 23; Hinkley, Nautilus, XVIII, 1904, p. 40.

Gyrotoma glans Lea, Binney, Check List, 1860, No. 320; Brot, List, 1862, p. 27.

Melatoma ellipticum Anth., MSS., Reeve, Monog. Melatoma, 1861, sp. 21.

Gyrotoma ellipticum Anth., Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Schizostoma ellipticum Anth., Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, p. 359; Lewis, Fauna of Ala., 1876, p. 23; Hinkley, Nautilus, XVIII, 1904, p. 40.

Description: Shell striate, subfusiform, rather thick, yellowish; spire ovately conical; sutures impressed; whorls flattened; aperture cut out above, small, elliptical, white.

Habitat: Alabama.

Diameter, .40; length, .64 of an inch.—Lea.

As variation goes in Gyrotoma this species is remarkably wanting in variability. At Wetumpka it bears folds in common with many other Pleuroceridae there and at Three-Island Shoals, the other extreme of its occurrence, it is ordinarily lighter in color and smooth. Otherwise there is little difference between the members of the two colonies. This may argue that *excisum* is the oldest of the genus, time having brought its usual uniformity, and this hypothesis is supported by the fact that the species has the longest range of all Gyrotomae.

The fissure is deep, up to 10 mm., in the largest adults, very narrow in the young and widening with age; ordinarily straight, but in a few shells

raving upon the lower edge. The girdle is thread-like to rounded and thick, nd of slightly lighter color than the body of the shell.

Forms are quadrate, bulbous, ovate, elongate, any one colony having pecimens of these shapes. Where folds occur they are low, not very conpicuous. Of 38 specimens in one lot taken at The Bar, 29 are obscurely licate upon the upper whorls, 9 are without plicae. This ratio of sculpured shells to those lacking plicae is about the same wherever the species ccurs. In general the shell is of a soft silky appearance. Color is anilineellow to mummy-brown. The commonest banding formula is three bands, he one at the periphery being wider than the others. The columella in the ldest specimens is heavy, broad, complete to the top and thickened at the ssure. Color is usually white, but at times yellowish-white, pink or purple. The sinus is distinct, pointed. The outer lip is slightly sinuous. Mr. Smith's largest *excisum* measured 23 x 12 mm.

The embryo is smooth, tightly coiled. Shells developed to the fifth horl are smooth with a slight carina at the periphery; the sinus being ell marked; the fissure straight, tight and about 3 mm. in depth. Partly rown individuals are not so angular at the base as in most other species. The whorls indicated for an adult are seven or eight.

Shuttleworth's shells from the Coosa River were sent to him by Rugel nd this collector took *pyramidatum* not far from the northernmost known ocality for *excisum*. It seems probable that the shell to which Shuttleorth gave the name *ovoideum* came from this point or very close to it. *G. llipticum* Anth. in the Philadelphia Academy, received from Anthony imself, is the same as his *bulbosum* except that it is elongate. *Bulbosum* is *xcisum* in its old age, *ovalis* in its graceful youth. The tuberculation of *lans,* cited by Tryon as if a distinguishing character, occurs rarely and eems to be without significance.

Gyrotoma laciniatum (Lea)

Pl. II, figs. 24 and 25

Schizostoma laciniatum Lea, Proc. Amer. Phil. Soc., IV, 1845, p. 167; Trans. Amer. Phil. Soc., X, 1848, p. 95, pl. ix, fig. 57; Obs. Gen. Unio, IV, 1848, p. 95, pl. ix, g. 57; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 253; Obs. Gen. Unio, IX, 1863, . 75; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 873, pp. xv, 359; Lewis, Fauna of Ala., 1876, p. 23.

Gyrotoma laciniata Lea, H. & A. Adams, Genera, I, 1858, p. 305; Binney, Check List, 1860, No. 324; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Schizostoma castanea Lea, Proc. Acad. Nat. Sci., Phila., XII, 1860, p. 186; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 247, pl. 35, fig. 50; Obs. Gen. Unio, X, 1863, p. 69, pl. xxxv, fig. 50; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, p. 355; Lewis, Fauna of Ala., 1876, p. 22; Hinkley, Nautilus, XVIII, 1904, p. 40.

Gyrotoma castanea Lea, Binney, Check List, 1860, No. 311; Brot, List, 1862, p. 7; Paetel, Cat., 1888, p. 361.

Gyrotoma olivula excisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 181.

Description: Shell smooth, obtusely conical, rather thick, banded, yellowish horn-color; spire obtuse; sutures excavated; whorls convex; fissure deep; aperture elliptical, whitish within; columella smooth, thickened above.

Habitat: Tuscaloosa, Alabama.

Diameter, .25; length, .45 of an inch.—Lea.

This is the smallest species of the genus. The largest shell examined measures 16 x 10 mm. The average size of fourteen specimens is 14.9 x 8.5 mm. The species resembles *excisum* Lea in sculpture, fissure and banding system. It occurs from Fort William Shoals, Talladega County, to Wetumpka, Elmore County. A note by Mr. Smith with *laciniatum* from Fort William Shoals reads, "Found in a few places along the eastern or Talladega County side and quite close to the banks where the water is swift; on or clinging to the lower side of stones. In one place, partly under overhanging bushes, we collected over 100 within a few yards, but generally the species is rare."

In *laciniatum* the fissure is very deep in porportion to the shell; it is narrow and hugs the body whorl. Its depth in adults is 7 to 7½ mm. The girdle is small and thin. Of 48 specimens the girdle is absent in 13.

The shell is conic, subangulated, with whorls flat to slightly convex. Upper whorls are smooth to carinate, showing a tendency to form a few obscure plicae. Commonly there are four or five low folds upon the base, seldom very distinct. Beneath the fissure are low vertical puckerings, made conspicuous by spots of coloring matter between them. Growth lines are fine, irregular, crossed on parts of the shell by revolving lines which in few instances go clear around the whorl. Color is buckthorn-brown to clove-brown. The prevailing banding formula is four bands of equal width, the two in the center approximate. These latter bands sometimes coalesce into the formula ordinarily occurring in *excisum*. The aperture is elliptical, nearly pointed at the top, more rounded at the base and having a slight sinus. The columella is small, regularly rounded, white and having a node at the fissure. In only one specimen observed was the columella developed fully above the center. The outer lip is sinuous, more angular at the top than rounded.

The embryo shell is very small, smooth, tightly coiled. Some juveniles are strongly carinate, others smooth. Irregular plicae occur. There are three bands, that at the center dividing into two. In shells of five whorls the fissure is quite deep. The adult *laciniatum* has seven or eight whorls.

A comparison of the types of *laciniatum* and *castaneum* proved them to be identical. Lea's first specimens were apparently from Wetumpka. It was not until about fifteen years later that he saw the up-river forms.

GROUP OF *Gyrotoma incisum*

Cylindrical to globose; whorls shouldered, often constricted, sometimes nodulous; smooth to striate; fissure usually shallow and oblique though in *amplum* as deep as 9 mm. and in instances straight; girdle stout and irregular when present; aperture ovate; sinus more noticeable in young than in adult shells; bands three.

Gyrotoma incisum (Lea)

Pl. II, figs. 26, 27, 28, and 29

Anculosa incisa Lea, Proc. Amer. Phil. Soc., II, 1843, p. 243; Trans. Amer. Phil. Soc., IX, 1844, p. 28.

Schizostoma incisa Lea, Wheatley, Cat. Shells U. S., 1845, p. 28; Lea, Trans. Amer. Phil. Soc., X, 1848, p. 93; Lea, Obs. Gen. Unio, IV, 1848, pp. 28, 93; Lea, Proc. Acad. Nat. Sci., Phila., XII, 1860, p. 186; Hanley, Conchol. Misc., Melania, 1854-58, pl. 5, figs. 44, 45; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, pp. xxiii, xxv, 378; Lewis, Fauna of Ala., 1876, p. 23; Hinkley, Nautilus, XVIII, 1904, pp. 40, 41.

Melania incisa Lea, Jay, Cat., 4th ed., 1852, p. 274.

Leptoxis incisa Lea, Haldeman, in Chenu's Illustrations Conchyliog., 1843-53, liv. 73, p. 2, pl. 1, figs. 24-26; Binney, Check List, 1860, No. 363.

Gyrotoma incisa Lea, H. & A. Adams, Genera, I, 1858, p. 305; Binney, Check List, 1860, No. 323; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362; Goodrich, Anculosae Ala. Drain., 1922, p. 56.

Gyrotoma laeta incisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 182.

Melatoma incisum Lea, Reeve, Monog. Melatoma, 1860, sp. 4.

Schizostoma curta Mighels, Bost. Proc., I, Oct. 1844, p. 189; Tryon, Monog. Strepom., 1873, pp. xv, 363; Lewis, Fauna of Ala., 1876, p. 22.

Gyrotoma curta Migh., H. & A. Adams, Genera, I, 1858, p. 305; Binney, Check List, 1860, No. 314.

Gyrotoma curta Gould, Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 361.

Gyrotoma olivula excisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 181.

Schizostoma Buddii Lea, Proc. Amer. Phil. Soc., IV, 1845, p. 167; Trans. Amer. Phil. Soc., X, 1848, p. 94, pl. ix, fig. 53; Obs. Gen. Unio, IV, 1848, p. 94, pl. ix, fig. 53; Obs. Gen. Unio, IX, 1863, p. 74; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, pp. xv, 370; Lewis, Fauna of Ala., 1876, p. 22.

Gyrotoma Buddii Lea, H. & A. Adams, Genera, I, 1858, p. 305; Binney, Check List, 1860, No. 308; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 361.

Schizostoma constrictum Lea, Proc. Amer. Phil. Soc., IV, 1845, p. 167; Trans. Amer. Phil. Soc., X, 1848, p. 94, pl. ix, fig. 55; Obs. Gen. Unio, IV, 1848, p. 94, pl. ix, fig. 55; Proc. Acad. Nat. Sci., Phila., XII, 1860, p. 186; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 246; Obs. Gen. Unio, IX, 1863, p. 68; Journ. Acad. Nat. Sci., Phila., VI, 1866, p. 149; Obs. Gen. Unio, XI, 1867, p. 105; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, pp. xv, 373, 374; Lewis, Fauna of Ala., 1876, p. 22.

Gyrotoma constricta Lea, H. & A. Adams, Genera, I, 1858, p. 305; Binney, Check List, 1860, No. 302; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 361.

Schizostoma funiculatum Lea, Proc. Amer. Phil. Soc., IV, 1845, p. 167; Trans. Amer. Phil. Soc., X, 1848, p. 95, pl. ix, fig. 56; Obs. Gen. Unio, IV, 1848, p. 95, pl. ix, fig. 56; Tryon, Monog. Strepom., 1873, pp. xv, 371.

Gyrotoma funiculata Lea, H. & A. Adams, Genera, I, 1858, p. 305; Binney, Check List, 1860, No. 318; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Gyrotoma quadrata Anthony, Proc. Acad. Nat. Sci., Phila., XII, Feb. 1860, p. 65; Binney, Check List, 1860, No. 330; Paetel, Cat., 1888, p. 362.

Melatoma quadratum Anth., Reeve, Monog. Melatoma, 1860, sp. 7.

Schizostoma virens Lea, Proc. Acad. Nat. Sci., Phila., XII, 1860, p. 187; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 253, pl. 35, fig. 59; Obs. Gen. Unio, IX, 1863, p. 75; pl. xxv, fig. 59.

Gyrotoma virens Lea, Binney, Check List, 1860, No. 335; Brot, List, 1862, p. 28; Paetel, Cat., 1888, p. 362.

Gyrotoma obliqua Anth., MSS., Tryon, Monog. Strepom., 1873, p. 378; Paetel, Cat., 1888, p. 362.

Description: Shell smooth, ovately gibbous, thick, yellowish-brown; spire short; whorls four, flattened; columella thickened above; aperture large, ovate, white.

Habitat: Alabama.

Diameter, .44; length, .64 of an inch.—Lea.

In *incisum* the fissure is shallow and oblique. It is as deep as 7½ mm. in specimens from Weduska Shoals. It is most shallow in specimens from Butting Ram Shoals down to Wetumpka, not exceeding 2¾ mm. in depth. The girdle, which represents the material filling the fissure as growth proceeds, is usually well-marked when it is noticeable at all, particularly toward the end of growth of adult individuals.

The shell is heavy, broadly rounded at the shoulder, frequently with a broad constriction around the center of the whorl. Hinkley (2, p. 40) speaks of *incisum* as never nodulous. Occasional specimens do have nodes at the shoulder, but these markings appear to be without significance. The largest shell observed measures 22 x 14½ mm. The growth lines are usually fine and regular and these are often crossed by discontinuous transverse lines, plainest at the top of the whorl. Of 78 shells from one lot from Wetumpka, 11 showed revolving folds of more or less prominence. The folds are seldom present in *incisum* coming from farther up the river. Color varies from olive-ocher to cinnamon-brown. Bands occur much more commonly than not. Of 77 banded shells from Wetumpka, 74 had a band at the top of the whorl, one at the periphery and a third at the base. This is the prevailing banding formula in the species from other localities. The aperture is ovate, varying slightly. The columella in adults is white, rather wide, broadly rounded and regularly curved vertically, being thickened into a small node at the mouth of the fissure. The outer lip is sharp-edged, sinuous.

Juveniles are conic, angulated at the base, having the whorls flat and without carinae. A channelled sinus, present in all the young examined, is much more pronounced than in the case of adults. The fissure begins with the third whorl and is easily distinguished in the fourth. Six or seven whorls for the fully-grown shell are indicated.

The range of *incisum* is from Weduska Shoals, Shelby County, to Wetumpka, Elmore County.

Lea's type is a narrow, somewhat constricted form of the Wetumpka aspect. His *virens* is a young shell. *Curta* Mighels appears to me to be readily recognizable from the description. I examined the type of *buddii* Lea, the locality for which is given in error as Tuscaloosa, but felt uncertain about the identification. Mr. W. B. Marshall of the National Museum kindly furnished me later with an excellent photograph and I can say with confidence that the shell is the same as *incisum*. The cut in Tryon (6, p. 371) could not have been made from the type. The constriction in *constrictum* is fairly common to the species. *Funiculatum* Lea is a deformed mollusk.

At the mouth of the Yellowleaf Creek of Chilton County, Mr. T. H. Aldrich took numbers of a small form of Gyrotoma which, though suggestive of *walkeri* because of its delicacy, I assign to *incisum* on account of the deeper fissure. These shells have a kind of family resemblance to *Anculosa aldrichi* H. H. Smith, taken at the same locality. This Anculosa also is

dwarfed. Larger Gyrotomae and larger Anculosae have been collected in the same place. The student is led to wonder whether these dwarfed shells do not dwell in some particular spot on these shoals where the conditions of food supply, current, temperature or some other cause tend to stunt molluscan growth as sometimes in very cold springs shell life is at once small and plainly of mature development.

Gyrotoma walkeri H. H. Smith, new species

Pl. II, figs. 30, 31, and 32

Shell: Cylindrical, shouldered, solid; body whorl slightly constricted, apex eroded, base rounded and with only a suggestion of a sinus. Growth lines very fine, crossed by delicate, waving lines to be seen on all parts of the exterior except where it is worn smooth. Rest period scars rather rough, forming a few irregularly spaced nodules. Fissure very shallow, very oblique, 2 mm. deep at the suture. There is no girdle. Suture impressed, irregular. Color buckthorn-brown. Bands three, one ending at lower edge of fissure, one at periphery and one at the base. Aperture ovate, yellowish-white within. Columella white, broadly-rounded, having a heavy deposit of its material at the fissure. Outer lip firm, sharp-edged, forming a sinuous line with the fissure.

Operculum: Ovate, thick, dark reddish-brown, measuring 3 1-2 mm. diameter by 5 1-2 mm. altitude. The left margin is thickened, smooth-edged; right margin broadly curved, broken and worn; basal margin rounded, eroded close to the polar point. Whorls three, the first two regularly and tightly coiled. Growth lines fine to coarse.

Measurements: Altitude, 15 mm.; diameter, 10 mm. Aperture, base to suture, 10 1-2 mm.; base to lowest point of fissure, 6 mm.; diameter 4 1-4 mm.

Type Locality: Coosa River, Cedar Island, Chilton County, Alabama.

Type in Museum of Zoology, University of Michigan; paratypes in Alabama Museum of Natural History.

This species appears to be a derivative of *G. incisum* Lea which has developed fixed, uniform specific characteristics. It is small for the genus and varies much more in the size of mature specimens than in form. The largest shell measures 17 x 11 mm. It is from Weduska Shoals. No folds appear upon any of the material. Growth lines are usually fine, but sometimes coarse and roughened near the shoulder. The waving transverse lines are strikingly beautiful in a few specimens which have not suffered a great amount of wear.

The fissure varies slightly in depth, but in none is it deeper than 3½ mm. It is frequently only a sinuous indentation. The girdle is absent in all the specimens examined.

Color is sometimes as dark as burnt-umber. Of 65 shells, 51 have bands, the formula in all being exactly that of the type.

Very young shells are smooth, lacking carinæ, plicæ and all other sculpture except microscopic growth lines. The base is obtusely angulate. The sinus is well-marked, slightly oblique. The fissure, about ½ mm. deep, begins with the fourth whorl and is hardly more than a sinuous, inturned part of the outer lip. Eight whorls are indicated for full-grown individuals.

The known localities for *walkeri* are Weduska Shoals, Shelby County; The Bar, Cedar Island, Higgin's Ferry and Duncan's Riffle, Chilton County; Butting Ram Shoals, Coosa County. One of Mr. Smith's labels carries the note, "swift water."

Gyrotoma amplum Anthony

Pl. II, figs. 33, 34, and 35

Gyrotoma ampla Anth., Proc. Acad. Nat. Sci., Phila., XII, Feb., 1860, p. 66; Binney, Check List, 1860, No. 306; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 361.

Melatoma amplum Anth., Reeve, Monog. Melatoma, 1861, sp. 16.

Schizostoma amplum Anth., Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, p. 360; Lewis, Fauna of Ala., 1876, p. 22.

Gyrotoma recta Anth., Proc. Acad. Nat. Sci., Phila., XII, Feb., 1860, p. 64; Binney, Check List, 1860, No. 331; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Melatoma rectum Anth., Reeve, Monog. Melatoma, 1861, sp. 10.

Gyrotoma salebrosa Anth., Proc. Acad. Nat. Sci., Phila., XII, Feb., 1860, p. 66; Binney, Check List, 1860, No. 333; Paetel, Cat., 1888, p. 362.

Melatoma salebrosum Anth., Reeve, Monog. Melatoma, 1861, sp. 15.

Schizostoma salebrosum Anth., Lewis, Amer. Journ. Conchol., V, 1869-70, p. 169; Tryon, Monog. Strepom., 1873, p. 376; Lewis, Fauna of Ala., 1876, p. 23; Hinkley, Nautilus, XVIII, 1904, p. 40.

Gyrotoma robusta Anth., Proc. Acad. Nat. Sci., Phila., XII, Feb., 1860, p. 67; Binney, Check List, 1860, No. 332; Brot, List, 1862, p. 28; Paetel, Cat., 1888, p. 362.

Melatoma robustum Anth., Reeve, Monog. Melatoma, 1861, sp. 14.

Gyrotoma demissa Anth., Proc. Acad. Nat. Sci., Phila., XII, Feb., 1860, p. 64; Binney, Check List, 1860, No. 316; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Melatoma demissum Anth., Reeve, Monog. Melatoma, 1861, sp. 9.

Schizostoma demissum Anth., Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, p. 372; Lewis, Fauna of Ala., 1876, p. 23.

Schizostoma glandula Lea, Proc. Acad. Nat. Sci., Phila., XII, May, 1860, p. 187; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 249, pl. 35, fig. 53; Obs. Gen. Unio, IX, 1863, p. 71, pl. 35, fig. 53; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 168; Tryon, Monog. Strepom., 1873, p. 377; Lewis, Fauna of Ala., 1876, p. 23.

Gyrotoma glandula Lea, Binney, Check List, 1860, No. 319; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Schizostoma Hartmanii Lea, Proc. Acad. Nat. Sci., Phila., XII, May, 1860, p. 187; Journ. Acad. Nat. Sci., Phila., V, n. s., p. 247, pl. 35, fig. 51; Obs. Gen. Unio, IX, 1863, p. 69, pl. 35, fig. 51.

Gyrotoma Hartmanii Lea, Binney, Check List, 1860, No. 322; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Melatoma nucula Anth., MSS., Reeve, Monog. Melatoma, 1861, sp. 19.

Gyrotoma nucula Anth., Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Schizostoma nuculum Anth., Lewis, Amer. Journ. Conchol., V, 1869-70, p. 169; Tryon, Monog. Strepom., 1873, p. 361; Lewis, Fauna of Ala., 1876, p. 23.

Schizostoma Showalterii Lea, (non Lea, 1860), Proc. Acad. Nat. Sci., Phila., XVI, 1864, p. 112; Journ. Acad. Nat. Sci., Phila., VI, 1866, p. 149, pl. 23, fig. 56; Obs. Gen. Unio, XI, 1867, p. 105; pl. 23, fig. 56.

Schizostoma Showalteriana "Lea", Tryon, Amer. Journ. Conchol., I, Oct., 1865, p. 335; Tryon, Monog. Strepom., 1873, p. 375; Lewis, Fauna of Ala., 1876, p. 23.

Schizostoma constrictum Lea, Hinkley, Nautilus, XVIII, 1904, p. 40.

Gyrotoma olivula excisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 181.

Gyrotoma laeta incisa (Lea), Hannibal, Proc. Malacol. Soc., 1912, p. 182.

Description: Shell smooth, ovate, rather thick, olivaceous; spire not elevated, but acute; whorls 6-7, subconvex; sutures well defined; fissure broad, rather deep and waved; aperture moderate, elliptical, flesh-colored and banded within; columella

smooth, or slightly thickened only at the fissure; body whorl striate and banded; whorls of the spire not banded, but having a thickened, cord-like line near the suture.

Habitat: Coosa River, Alabama.

Length, eleven-sixteenths; breadth, seven-sixteenths of an inch. Length of aperture, seven-sixteenths; breadth of aperture, four-sixteenths of an inch.—Anthony.

This species is close to the form of *incisum* which has a comparatively deep fissure, as at Weduska Shoals. But the young of that form have the typically shallow fissure. It is not so in the case of *amplum*. Moreover, the fissure in *amplum* is sometimes straight, never in *incisum*. Sometimes the lower edge of the fissure of *amplum* is waved, but this has not been observed in *incisum*. The depth of the slit in the species under consideration varies in adults from 6½ to 9 mm. The girdle is stout, often irregular.

In form the shell is somewhat cylindrical, noticeably shouldered and in instances slightly constricted though not so frequently or so deeply as in *incisum*. Ordinarily the mollusk is without revolving folds, but occasionally they do occur. Commonly the body whorl bears low nodules just below the suture. Growth lines are fine, often prominent and are crossed in places by waving transverse lines usually discontinuous. The largest specimen taken by Mr. Smith measures 23½ x 14½ mm. Color varies from olive-yellow to Mars-brown. The prevailing banding formula is three bands equidistant and of the same width. Bands in this species show a marked tendency to become obsolete. The columella is white to bluish-white, having a porcelainous node at the fissure and ending at the base in a distinct sinus.

Anthony erected several species at the same time from shells which seem to have come from Dr. Schowalter just after that collector's first visit to Fort William Shoals. Their novelty led to the placing of undue emphasis upon characters of no great significance. Thus *recta* was made a species principally upon the form of the shell and the absence of bands. The accentuation of rest scars was the justification of *salebrosa*. *Robusta* was differentiated from *salebrosa* by reason of its smoothness. *Demissa,* a single specimen, appears to have been one of the not very common adults of the genus which have a fully developed columella. Dr. Lea published his descriptions of *hartmanii* and *glandula* hardly three months after Anthony's names had been printed. His *hartmanii* is an old, worn and broken specimen of *amplum*. It is somewhat difficult to distinguish *glandula* from *incisum,* but I was enabled to do this with care by means of a photograph sent to me by Mr. W. B. Marshall of the United States National Museum. *Showalteriana* is a pathological individual. The synonymy of *amplum* is an illustration of a curious competition in species-naming which obtained among American naturalists in the first half of the nineteenth century.

Hinkley (2, p. 40), who found this to be the most plentiful Gyrotoma on Fort William Shoals, identified it as *constrictum,* apparently following Tryon's decision in the case of *recta*. I have seen both the type of *constrictum* and some of Hinkley's shells and can say confidently they are not the same.

The range of the species is Three-Island Shoals to Peckerwood Shoals.

UNIDENTIFIABLE SPECIES

Gyrotoma babylonicum (Lea)

Schizostoma Babylonicum Lea, Proc. Amer. Phil. Soc., IV, 1845, p. 167; Trans. Amer. Phil. Soc., X, 1848, p. 94, pl. ix, fig. 54; Obs. Gen. Unio, IV, 1848, p. 94, pl. ix, fig. 54; Journ. Acad. Nat. Sci., Phila., V, n. s., 1862, p. 248; Obs. Gen. Unio, IX, 1863, p. 70; Lewis, Amer. Journ. Conchol., V, 1869-70, p. 166; Tryon, Monog. Strepom., 1873, pp. xv, 369; Lewis, Fauna of Ala., 1876, p. 22.

Gyrotoma Babylonicum Lea, Chenu, Man. de Conchyl., I, 1859, f. 2, 021; H. & A. Adams, Genera, I, 1858, p. 305; Binney, Check List, 1860, No. 307; Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 361.

Gyrotoma lacta incisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 182.

Description: Shell striate, somewhat fusiform, rather thick, chestnut-color; spire obtusely conical; sutures impressed; whorls flattened; fissure small; aperture large, elliptical, somewhat flesh-colored within; columella smooth, angular at the base, thickened above.—Lea.

This species was described from one specimen and as from Tuscaloosa. Like Lea's *funiculatum* and his *showalterii* of 1864 it is a deformity and broken. The shell is now in the National Museum, being No. 119, 408. It is very much shouldered and is lacking in color bands. The fissure is slightly more oblique than in specimens of *pagoda* having unusually oblique fissures. It is much more oblique than in the case of *pumilum* which the shell of *babylonicum* resembles. While the mollusk does not suggest *incisum* in form, the fissure is that of many specimens of this species. I feel unable to decide as to which of these species *babylonicum* belongs. The chief characteristic upon which its specific position was established does not obtain among thousands of Gyrotoma examined. It is unquestionably an abnormal shell. If it should be decided that *babylonicum* is the same as *pumilum* the latter species, described in 1860, will go into the synonymy.

Hinkley (2, p. 41) made this shell a synonym of *wetumpkaensis* and the latter the same as *pyramidatum*. Whatever *babylonicum* may be it belongs to the members of the genus occurring at Wetumpka, while *pyramidatum* is the first species appearing in the river and does not go down to Elmore County.

Gyrotoma cylindraceum (Mighels)

Schizostoma cylindracea Mighels, Bost. Proc., I, Oct. 1844, p. 189; Tryon, Monog Strepom., 1873, pp. xv, 361; Lewis, Fauna of Ala., 1876, p. 23; Hinkley, Nautilus, XVIII, 1904, p. 40.

Gyrotoma cylindracea Migh., H. & A. Adams, Genera, I, 1858, p. 305.

Gyrotoma cylindracea Mull., Binney, Check List, 1860, No. 315.

Gyrotoma cylindracea Gould, Brot, List, 1862, p. 27; Paetel, Cat., 1888, p. 362.

Gyrotoma olivula excisa (Lea), Hannibal, Proc. Malacol. Soc., X, 1912, p. 181.

Description: Shell nearly smooth, cylindrical, thick, with slight, revolving undulations; epidermis olivaceous; spire ovate-conic, eroded; whorls three or four, flattened, shouldered; suture distinct, aperture oval; fissure deep and wide.—Mighels.

The author gave Warrior River, Alabama, as the locality for his species. Mr. C. W. Johnson informs me that the Mighels collection was destroyed in the fire which burned the quarters of the Portland Society of Natural History in 1854, another fire in 1866 destroying a second collection. The

type of *cylindraceum* must be considered lost and the species cannot be recognized with any exactness from the description. Hinkley (2, p. 40) thought the shell might be a form of *ellipticum* Anth.

SPURIOUS SPECIES

Melatoma sphaerica Anth. is apparently an Anculosa belonging to a described species of the group *A. picta* Conrad. Habitat, Coosa River, Alabama. References:

Melatoma sphaerica Anth., MSS., Reeve, Monog. Melatoma, sp. 8, April, 1861.

Schizostoma sphaericum Anth., Lewis, Amer. Journ. Conchol., V, 1869-70, p. 169; Tryon, Monog. Strepom., 1873, p. 364; Lewis, Fauna of Ala., 1876, p. 23.

Anculosa sp., Goodrich, Anculosae of Ala. River Drain., 1922, p. 56.

H. & A. Adams list *Gyrotoma altilis* Anth., *conica* Say, *curvata* Say and *foremanii* Lea. The *altilis* possibly refers to *Gillia altilis* Lea. Shuttleworth's *G. conica* may be intended or *Melania conica* Say, a Pleurocera. Tryon (10, p. 132) appears to think that *curvata* refers to *Pleurocera curvatum* Lea. Two Melanians were named *foremanii* by Lea, but neither belongs to Gyrotoma. Paetel repeats these errors and adds *aequalis* Lea, *circumlineata* Tryon, *Coosaensis* Lea, *ellipsoides* Lea, *rubicunda* Lea and *vauxiana* Lea, all belonging to other genera than Gyrotoma, besides *angulata* Lea, having reference probably to *Melania angulata* Anth., a Goniobasis.

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11. WILLIS, J. C., "Age and Area." Cambridge, 1922.

PLATE I

GYROTOMA

All figures of shells are 3/2 times natural size

Figures 1, 2, and 3. *G. pyramidatum* Shuttleworth. Coosa River, Ten-Island Shoals, St. Clair County. (Cat. No. 27425.)

Figures 4 and 5. *G. spillmanii* (Lea). Coosa River, Shelby County. Schowalter Collection. (Cat. No. 27426.)

Figures 6, 7, and 8. *G. pagoda* (Lea). Coosa River, Higgins Ferry, Chilton County. (Cat. No. 27427.)

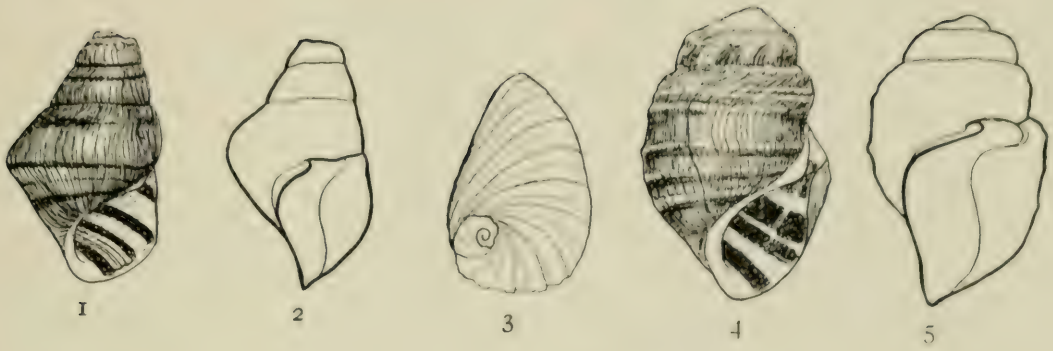
Figure 9. *G. pagoda* (Lea). Coosa River, Higgins Ferry, Chilton County. Young shell. (Cat. No. 27428.)

Figures 10 and 11. *G. pumilum* (Lea). Coosa River, Wetumpka, Elmore County. (Cat. No. 27429.)

Figures 12 and 13. *G. alabamensis* (Lea). Coosa River, Weduska Shoals, Shelby County. (Cat. No. 27430.)

Figures 14 and 15. *G. cariniferum* Anthony. Coosa River, Ft. William Shoals, Talladega County. (Cat. No. 27431.)

Figures 16, 17, and 18. *G. lewisii* (Lea). Ft. William Shoals, Talladega County. (Cat. No. 27432.)



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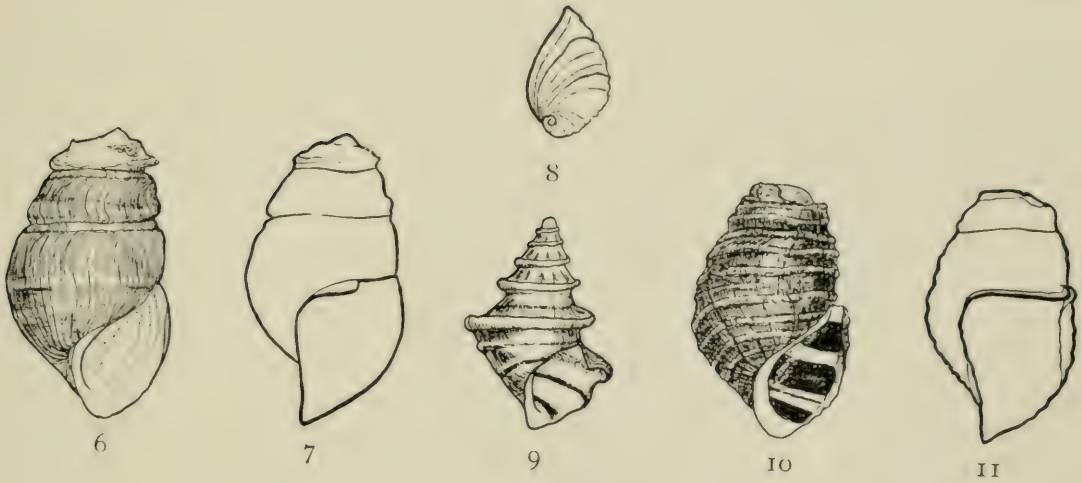

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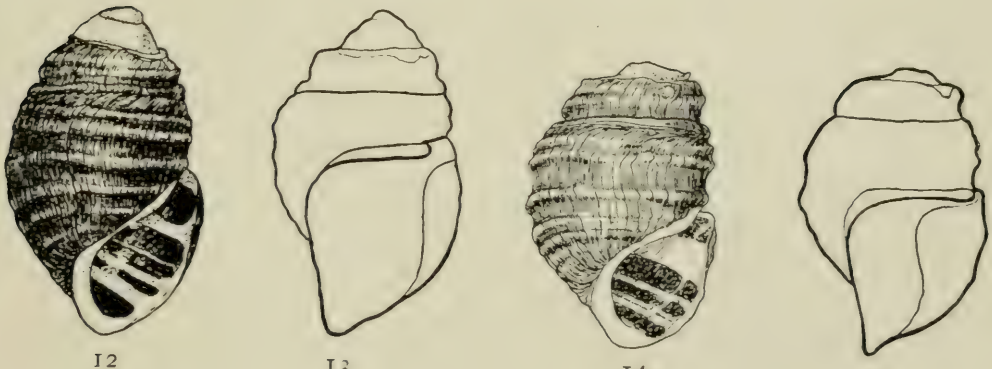

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PLATE 11

GYROTOMA

All figures of shells are 3/2 times natural size

Figures 19, 20, and 21. *G. hendersoni* H. H. Smith. Type. Coosa River, Ft. William Shoals, Talladega County. (Cat. No. 27433.)

Figures 22 and 23. *G. excisum* (Lea). Coosa River, Higgins Ferry, Chilton County. (Cat. No. 27434.)

Figures 24 and 25. *G. laciniatum* (Lea). Coosa River, Weduska Shoals, Shelby County. (Cat. No. 27435.)

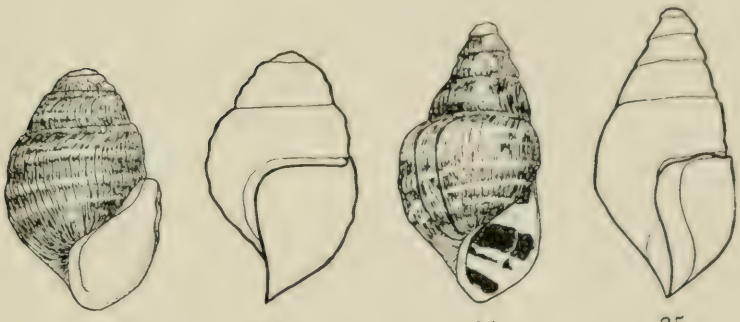
Figures 26 and 27. *G. incisum* (Lea). Coosa River, Wetumpka, Elmore County. (Cat. No. 27436.)

Figures 28 and 29. *G. incisum* (Lea). Coosa River, Weduska Shoals, Shelby (Cat. No. 27437.)

Figures 30, 31, and 32. *G. walkeri* H. H. Smith. Type. Coosa River, Cedar Island, Chilton County. (Cat. No. 27438.)

Figures 33, 34, and 35. *G. amplum* Anthony. Coosa River, Ft. William Shoals, Talladega County. (Cat. No. 27439.)

19 20 21



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